News about

B. F. Goodrich Chemical *raw materials*

RUBBER compounders find many processing advantages with Good-rite Vultrol. It prevents scorching the year 'round . . . retards scorch at processing temperatures and also acts as a mild activator at curing temperatures.

MORE ADVANTAGES → Good-rite Vultrol is beneficial on highly-loaded or highly-accelerated compounds. It is particularly effective with high abrasion furnace blacks. Vultrol permits uninterrupted production, reduces "dead" stocks, requires no special handling.

Supplied as a free-flowing flake, Good-rite Vultrol is economical and easy to use—saves time, money and labor. For information, please write Dept. HB-7, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Good-rite *Rubber Chemicals*

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors

Philblack* quality

You can count on the uniform high quality of Philblack for many good reasons.

Our Philblack process is carefully engineered to control critical variables as the selected Philblack feed stream is pyrolytically decomposed in the reactor.

While still loose and fluffy, Philblack is micropulverized to insure that less than a maximum of 0.005% is retained on an 80-mesh screen. Adequate physical and chemical tests are run on the black every two hours to insure constant quality in the Philblack you buy.

Equally important is the constant and strict examination Philblack undergoes in our own rubber evaluation laboratories.

Every Philblack quality of importance to rubber compounders and rubber consumers is investigated thoroughly on a continuing basis.

When you have any problem involving rubber and carbon black, we suggest that you take it up with our skilled staff. The Philblack man who calls on you is up-to-the-minute on rubber compounding technology.

We are always glad to hear from our customers and prospective customers. PHILLIPS CHEMICAL COMPANY, 318 Water Street, Akron 8, Ohio.

*A TRADEMARK

One moving bed catalytic cracking unit (above) and another fixed bed catalytic installation at Phillips, Texas supply recycle gas oil which is processed through a sulfur dioxide extraction plant to yield Philblack feed stock which meets strict specifications.

Abrasion loss of synthetic and natural rubber stocks is fully investigated using production Philblack in standard test recipes. Persistent testing of Philblack performance helps us assure the consistent high quality for which the Philblacks are famous.

Know the Philblacks!

KNOW WHAT THEY'LL DO FOR YOU!

A **Philblack A FEF Fast Extrusion Furnace**
Ideal for smooth tubing, accurate molding, satiny finish. Mixes easily. High, hot tensile. Disperses heat. Non-staining.

I **Philblack I ISAF Intermediate Super Abrasion Furnace**
Superior abrasion resistance at moderate cost. Very high resistance to cuts and cracks. More tread miles at high speeds.

O **Philblack O HAF High Abrasion Furnace**
For long, durable life. Good electrical conductivity. Excellent flex. Fine dispersion.

E **Philblack E SAF Super Abrasion Furnace**
Toughest black on the market. Extreme abrasion resistance. Withstands aging, cracking, cutting and chipping.

Phillips 66

PHILLIPS CHEMICAL COMPANY, Philblack Sales, 318 Water Street, Akron 8, Ohio. Export Sales: 80 Broadway, New York 5, N. Y. West Coast: Harwick Standard Chemical Company, Los Angeles, California. Canada: H. L. Blachford, Ltd., Montreal and Toronto.

Experience, a necessary ingredient in the manufacture of any product, is especially essential in roll making where only by long and intimate association with an industry, can its requirements be thoroughly understood and successfully provided for.

To United's 50 years of roll making experience can be added the advantages of its continuing program of metallurgical research, basically sound engineering and modern production facilities—a combination that made, and has kept, United Rolls favorites in outstanding processing plants throughout the world.

• • •

When in need of rolls—for whatever requirement—consult us.

UNITED ENGINEERING AND FOUNDRY COMPANY

PITTSBURGH, PENNSYLVANIA

Plants at Pittsburgh · Vandergrift · New Castle · Youngstown · Canton

Subsidiaries: Adamson United Company, Akron, Ohio; Lobdell United Company, Wilmington, Delaware; Stedman Foundry and Machine Co., Inc., Aurora, Ind.

Designers and Builders of Ferrous and Non-Ferrous Rolling Mills, Mill Rolls, Auxiliary Mill and Processing Equipment, Presses and other heavy machinery. Manufacturers of Iron, Nodular Iron and Steel Castings and Weldments.

OIL AND SOLVENT RESISTANCE PLUS

is yours with improved CHEMIGUM

OUTSTANDING oil and solvent resistance *plus* big advantages in processing and other properties are easily and economically yours with CHEMIGUM – first, now finest, of the butadiene-acrylonitrile copolymers.

Compared with other types of rubber, CHEMIGUM is far and away the most resistant to the attack of oils, fats, greases and many solvents. Compared to other nitrile rubbers, CHEMIGUM again gives you outstanding oil resistance *plus* much easier processing, faster sulfurless cures at lower cost, excellent physical properties and superior aging. And to all these plusses, you can add the latest – its lighter, easier-handling bale and its lighter, almost white color.

CHEMIGUM was the first of the nitrile rubbers. Through the years continual improvement has been made in its composition and production. Today, it stands out as an extremely uniform rubber of high, effective acrylonitrile content – specifically designed to process as do GR-S type rubbers. CHEMIGUM does not toughen on the mill, but actually softens with heat and mastication – a real, cost-saving feature.

Important, also, to costs are the easy-to-handle, 50-pound bale and the fact that CHEMIGUM gives you tight, sulfurless cures – permitting you to meet the most rigid automotive or military specifications – in much less time with less of the usual acceleration or with less costly ingredients.

But the best place to prove the oil and solvent resistance *plus* the other advantages of CHEMIGUM is in your own laboratory. Why not write for samples and full technical help, today? Just address your request to:

Goodyear, Chemical Division, Akron 16, Ohio

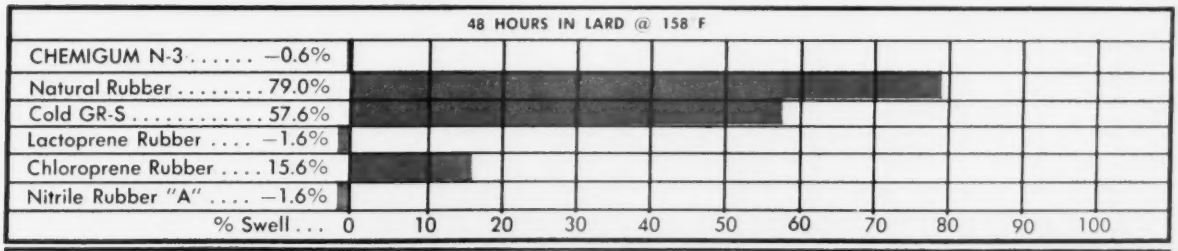
CHEMICAL GOODYEAR DIVISION

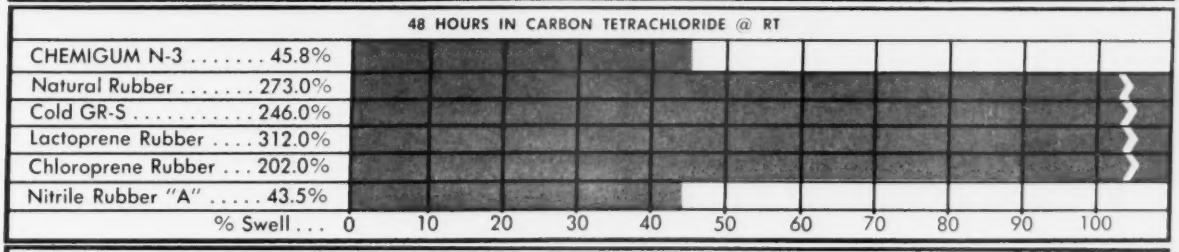
Chemigum, Pliobond, Pliolite, Plio-Tuf, Pliovic – T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

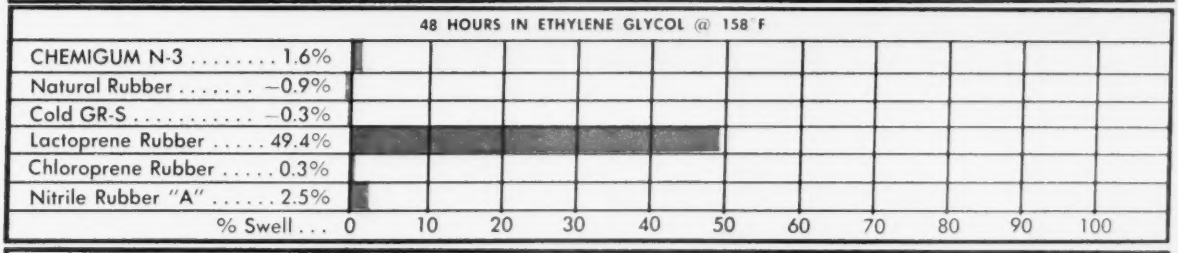
Use-Proved Products – CHEMIGUM • PLIOBOND • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS – The Finest Chemicals for Industry

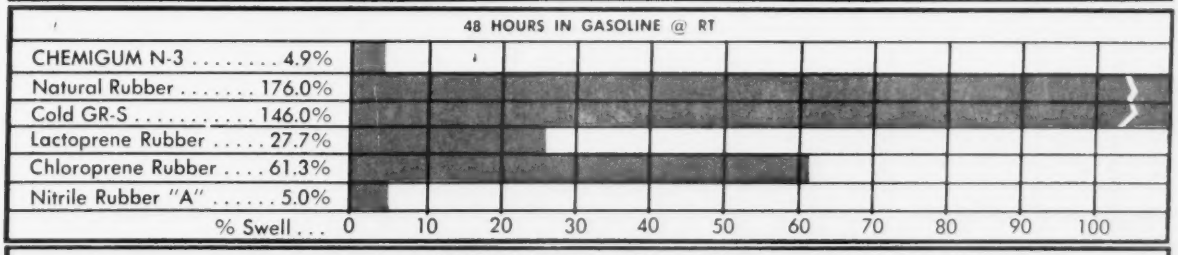
Superior Oil and Solvent Resistance – Comes with CHEMIGUM!

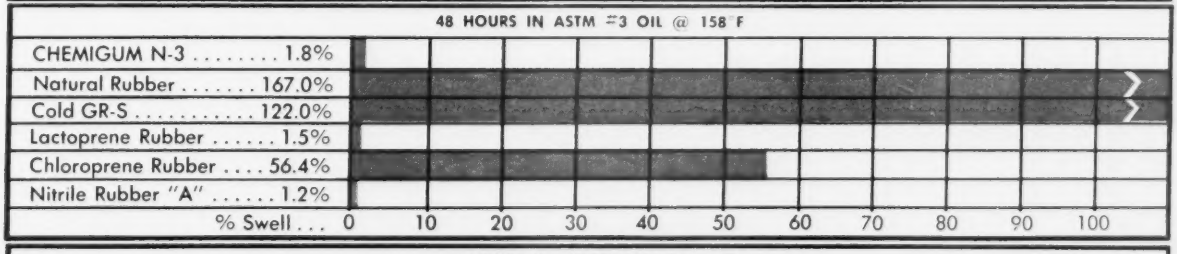
Here are the results of a series of tests which prove that CHEMIGUM offers the best all around resistance of any rubber, including one of high acrylonitrile content, to oils, fats, greases and solvents. A basic black compound was used with only the small changes necessary for proper cure of each type of rubber. The immersion tests were conducted on samples of the best cure for each stock.

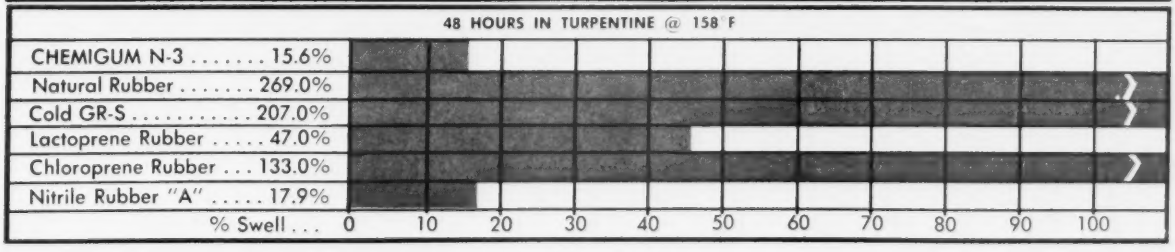

48 HOURS IN LARD @ 158 F
CHEMIGUM N-3 ..... −0.6%
Natural Rubber 79.0%
Cold GR-S 57.6%
Lactoprene Rubber .... −1.6%
Chloroprene Rubber 15.6%
Nitrile Rubber "A" .... −1.6%
% Swell ... 0 10 20 30 40 50 60 70 80 90 100

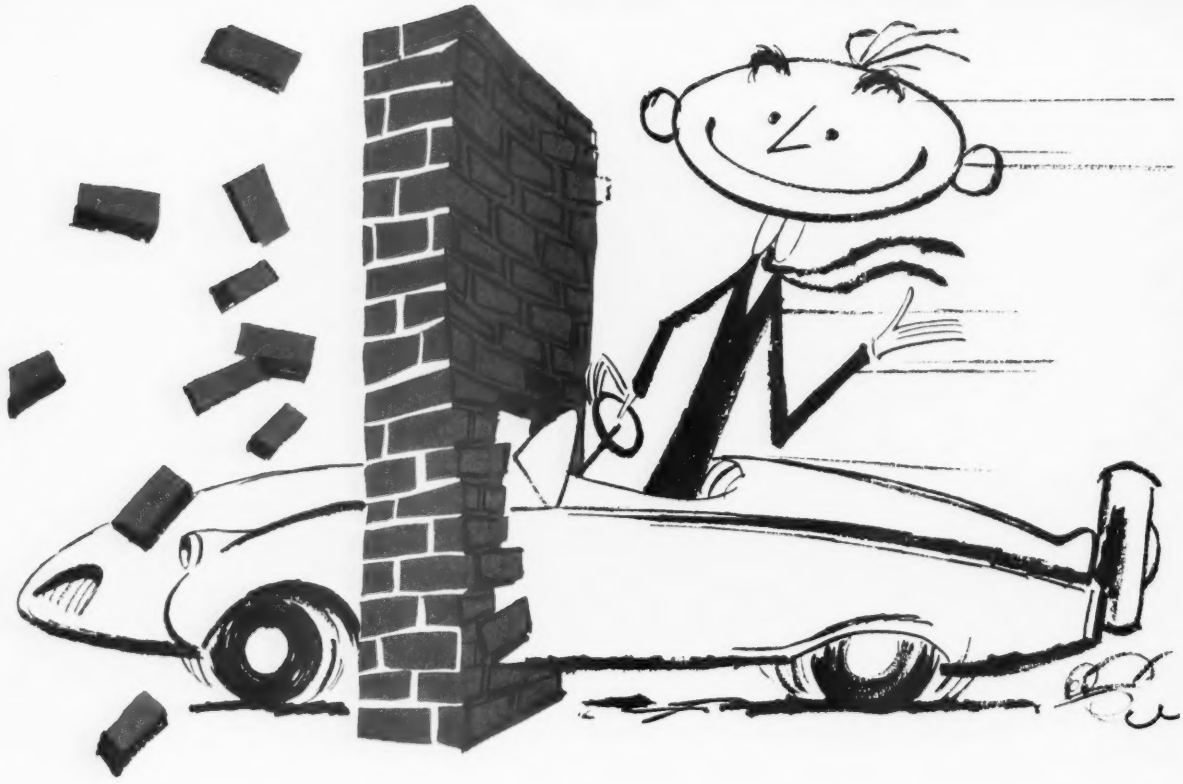

48 HOURS IN CARBON TETRACHLORIDE @ RT
CHEMIGUM N-3 ..... 45.8%
Natural Rubber 273.0%
Cold GR-S 246.0%
Lactoprene Rubber 312.0%
Chloroprene Rubber ... 202.0%
Nitrile Rubber "A" 43.5%
% Swell ... 0 10 20 30 40 50 60 70 80 90 100


48 HOURS IN ETHYLENE GLYCOL @ 158 F
CHEMIGUM N-3 ..... 1.6%
Natural Rubber ..... −0.9%
Cold GR-S ..... −0.3%
Lactoprene Rubber 49.4%
Chloroprene Rubber 0.3%
Nitrile Rubber "A" 2.5%
% Swell ... 0 10 20 30 40 50 60 70 80 90 100


48 HOURS IN GASOLINE @ RT
CHEMIGUM N-3 ..... 4.9%
Natural Rubber 176.0%
Cold GR-S 146.0%
Lactoprene Rubber 27.7%
Chloroprene Rubber 61.3%
Nitrile Rubber "A" 5.0%
% Swell ... 0 10 20 30 40 50 60 70 80 90 100


48 HOURS IN ASTM #3 OIL @ 158 F
CHEMIGUM N-3 ..... 1.8%
Natural Rubber 167.0%
Cold GR-S 122.0%
Lactoprene Rubber 1.5%
Chloroprene Rubber 56.4%
Nitrile Rubber "A" 1.2%
% Swell ... 0 10 20 30 40 50 60 70 80 90 100


48 HOURS IN TURPENTINE @ 158 F
CHEMIGUM N-3 ..... 15.6%
Natural Rubber 269.0%
Cold GR-S 207.0%
Lactoprene Rubber 47.0%
Chloroprene Rubber ... 133.0%
Nitrile Rubber "A" 17.9%
% Swell ... 0 10 20 30 40 50 60 70 80 90 100



How to get **Better Polyesters**

at Low Cost

Can you mold a glass reinforced polyester that's strong enough to push over a brick wall and inexpensive enough to compete in the auto body market? Perhaps not today. But someday you may be called on to meet specifications almost that tough. And when you are, you'll probably be relying on a DIAMOND ALKALI Calcium Carbonate as a filler to help you get smoother surfaces, decreased shrinkage, improved wet strength and *lower cost*.

If you are not familiar with the DIAMOND's tailor-made precipitated calcium carbonates, here are brief descriptions:

Suspenso®—particle size about 5 microns.

Surfex®MM—Same as Suspenso, coated with 1% resin.

Multifex®MM—Uncoated, particle size about .06 microns.

Kalite®—Size about 1 micron, coated with 1% stearic acid.

For more information, specific formula suggestions and technical assistance, call your nearest DIAMOND Sales Office or write DIAMOND ALKALI Co., 300 Union Commerce Bldg., Cleveland 14, Ohio.

DIAMOND SALES OFFICES:
New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis, Houston.

DIAMOND DISTRIBUTORS:
C. L. Duncan Co., San Francisco and Los Angeles; Van Waters and Rogers, Inc., Seattle and Portland, U.S.A.; Harrisons & Crosfield (Canada) Ltd.

DIAMOND ALKALI CHEMICALS ®

DIAMOND ALKALI COMPANY

CLEVELAND 14, OHIO

RUBBER FABRICATORS NEED ACCURATE CUTTING DIES

For Cutting

Rubber, Neoprene, Plastics, etc.
Sheeting, Foam, Sponge, Cellular,
Cured & Uncured

Gang Dies Our Specialty

- Accuracy to close Tolerances
- Durability
- Genuine Understanding of the problems of rubber goods manufacturers

MALLET HANDLE DIES

PURPOSE — For those who have no machinery and do not wish to purchase any. For Cutting — Rubber, Neoprene, Plastics, etc.

ADVANTAGE — Cut direct from bolts or not.

SERVICE—One to three days.

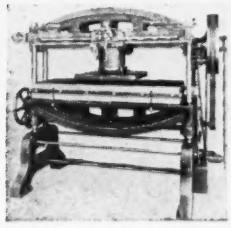
STEEL RULE CUTTING DIES

Used on Die Cutting Press, Printing Press or Power Press

PURPOSE — Especially suited for cutting — Rubber, Neoprene, Plastics, etc.

ADVANTAGE—Low in cost. Suitable for long production runs. It is necessary to cut from rectangular sheets which are fed into the press.

SERVICE—One day service.



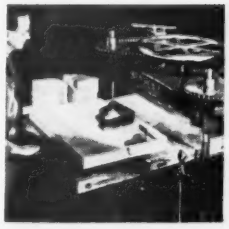
STEEL RULE CLICKER DIES

Use On Clicker Machine or Dinker Press

PURPOSE—For Cutting Rubber, Neoprene, Plastics, etc.

ADVANTAGE — More reasonably priced than the all steel dies. Recommended for small and medium quantities where cost of an all steel die is not warranted.

SERVICE—One day service.



ALL STEEL DIES

Use On Clicker Machine or Beam Press or Power Press

PURPOSE—For Cutting—Rubber, Neoprene, Plastics, etc.

ADVANTAGE — Cut direct from rolls without first cutting into sheets.

SERVICE—One to three day service on dies.

Dies for cutting
Gaskets, flashing from molded parts, rubber soles, foam and sponge for furniture padding, inflated toys, clothing and footwear, etc.

DIE CUTTING SERVICE

PURPOSE—For those who prefer to have their cutting done by others.

ADVANTAGE—We can die cut your product for you on our own presses rapidly and economically at a low "per thousand" cost.

SERVICE—One to three days.

SAME DAY SERVICE

ACCURATE

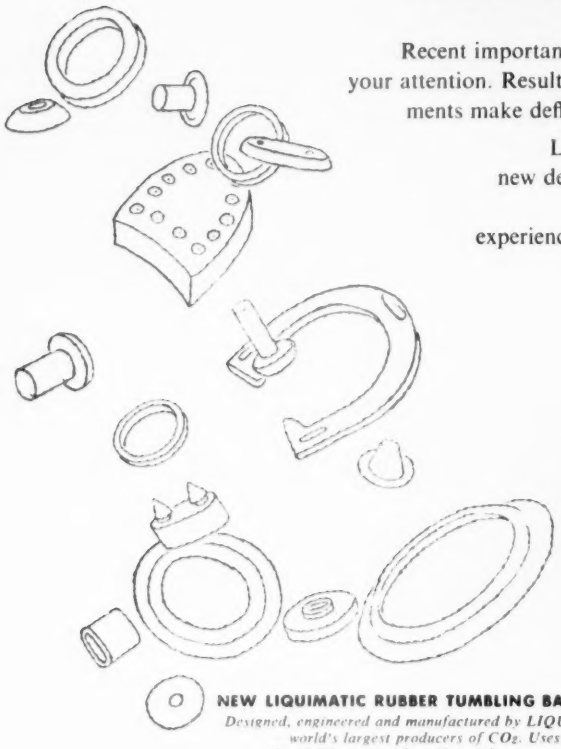
STEEL RULE DIE MANUFACTURERS

24-28 West 21st Street, New York 10, N. Y. CHelsea 2-0860-1

Subsidiaries: American Fabricators; Interstate Die Cutting Co., Inc.

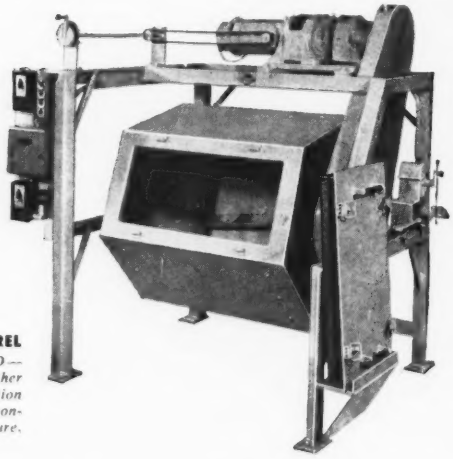
Intelligent Service to the Rubber Goods Industry for Over 23 Years

New Developments in CO_2 rubber tumbling Cut Deflashing costs



Recent important developments in CO_2 rubber tumbling deserve your attention. Results of intensive LIQUID research, these improvements make deflashing more efficient, economical and practical.

LIQUID engineers are anxious to discuss these new deflashing developments with your engineering or production personnel. These qualified, experienced experts are always available for consultation on any CO_2 or Dry Ice application. Just mail the coupon below.



NEW LIQUIMATIC RUBBER TUMBLING BARREL
Designed, engineered and manufactured by LIQUID — world's largest producers of CO_2. Uses either liquid CO_2 or Dry Ice. Heavy duty construction throughout. Stainless steel, 3" Rubatex insulated construction. Automatic control of time and temperature.

RED DIAMOND CO_2

IN WHICHEVER FORM YOU PREFER . . .

SOLID

RED DIAMOND Dry Ice

In the familiar 10" blocks.

LIQUID

Liquiflow

Tank truck to CO_2 receiver.

LIQUID also produces:
Gasweld Flame Welding and Cutting Equipment • Red Diamond Commercial Gases – Acetylene, Oxygen, Hydrogen and Nitrogen • A full line of Arc and Spot Welding Equipment and supplies

THE LIQUID CARBONIC CORPORATION
3100 SOUTH KEDZIE AVENUE • CHICAGO 23, ILLINOIS

THE LIQUID CARBONIC CORPORATION
3102 SOUTH KEDZIE AVENUE • CHICAGO 23, ILLINOIS

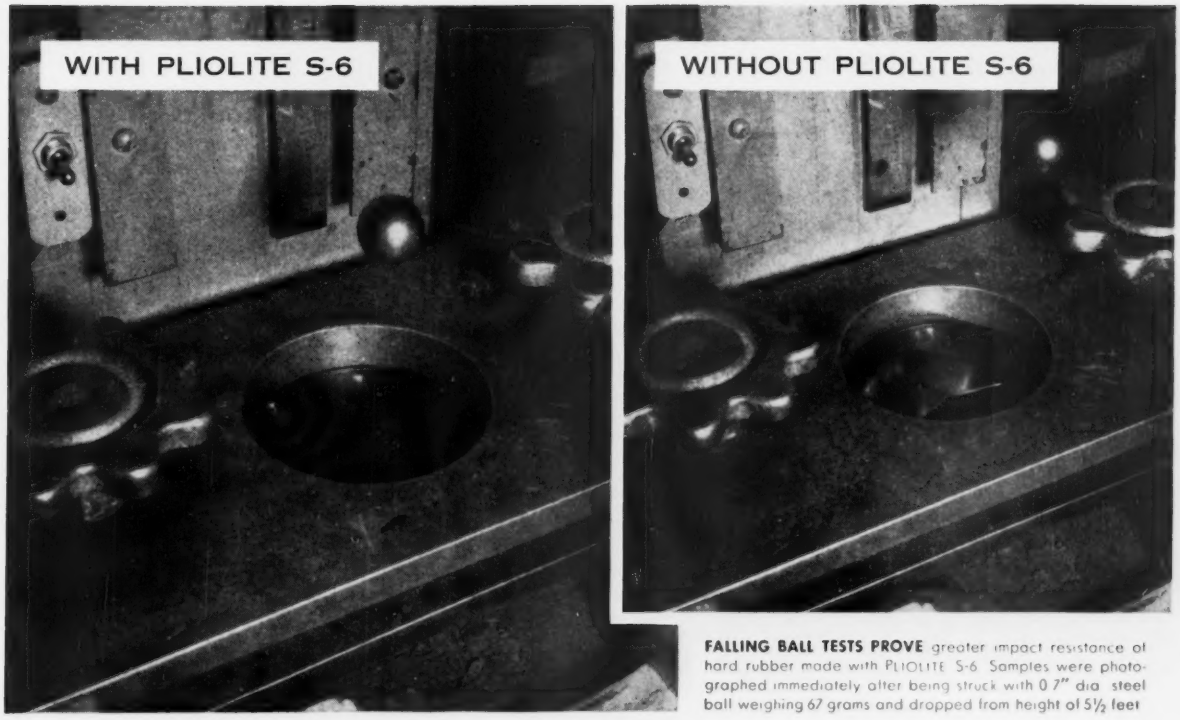
I would like more information on LIQUID's new developments in Rubber Tumbling.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____



FALLING BALL TESTS PROVE greater impact resistance of hard rubber made with PLIOLITE S-6. Samples were photographed immediately after being struck with 0.7" dia. steel ball weighing 67 grams and dropped from height of 5½ feet

TOUGHER HARD RUBBER

is easier made with PLIOLITE S-6

Hard rubber manufacturers always have been hard put to overcome an inherent limitation of their product—low impact resistance. They also have been plagued with difficult processing and generation of heat in the curing of high sulfur stocks.

Answers to all three of these problems are now at hand through the use of PLIOLITE S-6 – Goodyear's rubber reinforcing, high styrene copolymer. Recent studies and tests have proved that incorporation of PLIOLITE S-6 in hard rubber gives these improvements:

1. Much higher impact strength, depending upon the amounts of resin and sulfur used.
2. Use of lower sulfur levels without reduction in hardness, stiffness, tensile strength or softening point.
3. Safer production through control of the exothermic curing reaction plus permitted use of thicker sections and faster cures.
4. Easier production through nerve reduction and stiffening of the stock to give better handling, milling and preforming properties.
5. Better appearance of the cured stock surface.

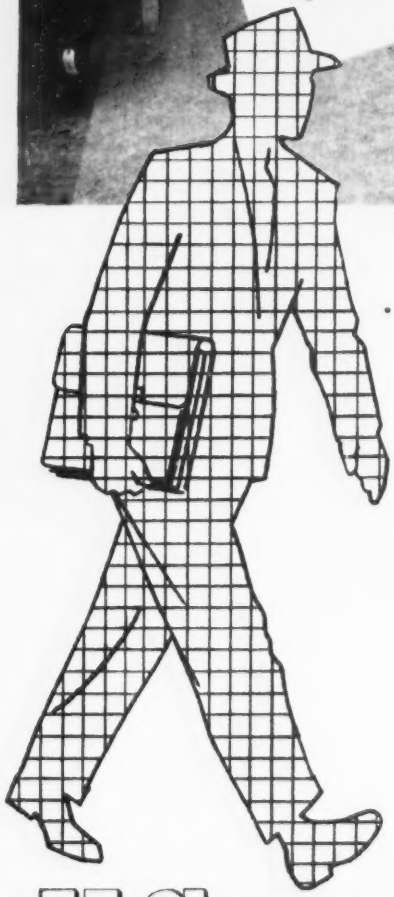
For further details on how to produce tougher hard rubber easier with PLIOLITE S-6, write to:

Goodyear, Chemical Division, Akron 16, Ohio

CHEMICAL GOODYEAR DIVISION

Pliolite, Chemigum, Pliobond, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

Use-Proved Products — CHEMIGUM · PLIOBOND · PLIOLITE · PLIOVIC · WING-CHEMICALS — The Finest Chemicals for Industry



...backed up by a fine LABORATORY STAFF

When is a salesman NOT a salesman? That's when you throw a tough, technical question at him and he comes up with the right answer! Our salesmen have been coming up with the right answers for years because they are all TRAINED RUBBER TECHNOLOGISTS. They are fully capable of intelligently discussing your compounding or processing problems. This "know-how" type of sincere selling has been building firm, friendly and financially sound business for our customers and ourselves for over 70 years.

Naturally, we don't mean that our salesmen are all top-drawer rubber research chemists, but when the questions get that tough, they have the rare good sense to tell you: "I don't know, but I'll find out". For them to get a fast answer to a "toughie" at our plant doesn't take long either, because we back up our sales staff with an experienced, fast-moving laboratory group. Our past achievements and national recognition attest to this.

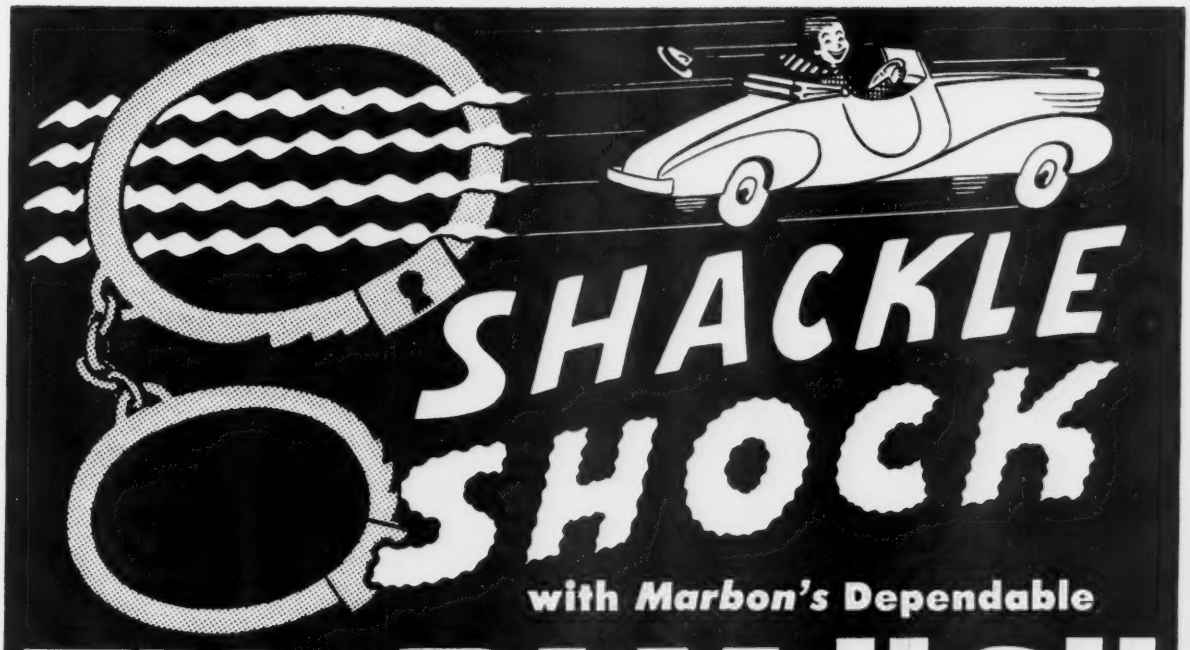
Next time you have a compounding or processing problem and need assistance, call in your U. S. Rubber Reclaiming Co. salesman. He knows how to help you.

U.S.

Our 71st year serving the industry solely as reclaimers

RUBBER RECLAIMING COMPANY, INC.

P. O. BOX 365 BUFFALO 5, N. Y.



SHACKLE SHOCK

with *Marbon's* Dependable

TY·PLY "S"

THE VERSATILE, CONSISTENT ADHESIVE FOR BONDING NEOPRENE

TY-PLY "S" is ideal for bonding Neoprene compounds of all types in static and dynamic uses — tension, shear and compression; such as motor mounts, diaphragms, industrial rolls, seals and shock absorbers.

TY-PLY "S" resistance to acid, alkali, salts and alcohols makes it especially effective as a bonding agent for Neoprene in tank and pipe linings, ventilating ducts, industrial pumps, etc.

TY-PLY Q or 3640 for bonding Natural, GR-S, and Butyl

TY-PLY BN for bonding N-types

TY-PLY will adhere most vulcanizable rubber compounds to almost any clean metal surface

Marbon

MARBON CORP.

GARY, INDIANA

SUBSIDIARY OF BORG-WARNER

TY-PLY has stood the test of time . . . since '39

all dolled up with Titanox®

Cuddly dolls, the kind every little girl wants, are most warm and appealing when the rubber or plastic has the realistic coloration provided by TITANOX white pigments. Proper pigmentation adds tremendously to the sales appeal of any rubber product, from dolls to white wall tires.

TITANOX titanium dioxide pigments are compatible with all types of rubber and plastics. These strongest of white pigments add quality by imparting whiteness and maximum brightness and opacity to white or tinted products while maintaining natural strength and life.

Consult with our Technical Service Department for the solution to any rubber or plastic pigmentation problem you may have. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; Atlanta 2; Boston 6; Chicago 3; Cleveland 15; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 9, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

®TITANOX

the brightest name in pigments

2239

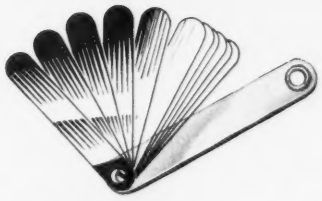
TITANIUM PIGMENT CORPORATION

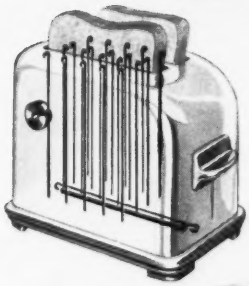
Subsidiary of NATIONAL LEAD COMPANY

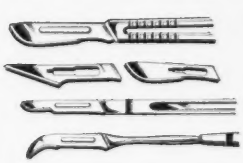
with

NATIONAL-STANDARD

Wire and High Carbon Strip



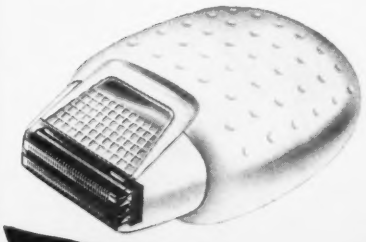


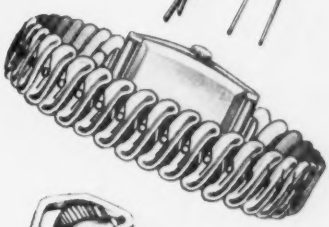


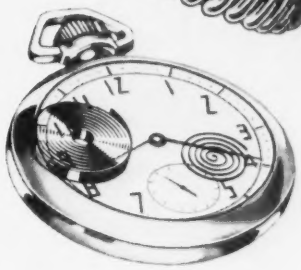
● The many and varied applications of National-Standard special-purpose steel are practically unlimited. Every day, new products and new manufacturing methods are developed that more than ever demand the precise control, high quality and uniformity that only National-Standard specialization offers.

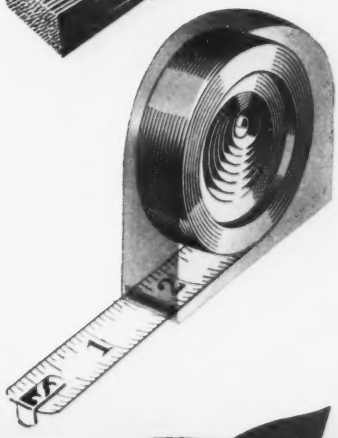
Here we produce steel, wire and strip, to meet unusually severe specifications and are constantly developing special types for new uses. Glad to cooperate with you in best meeting your needs, National-Standard offers an enviable 48-year record of supplying outstanding material, workmanship and service to end-use manufacturers.

For additional information or engineering assistance, write to the appropriate National-Standard Division listed below.









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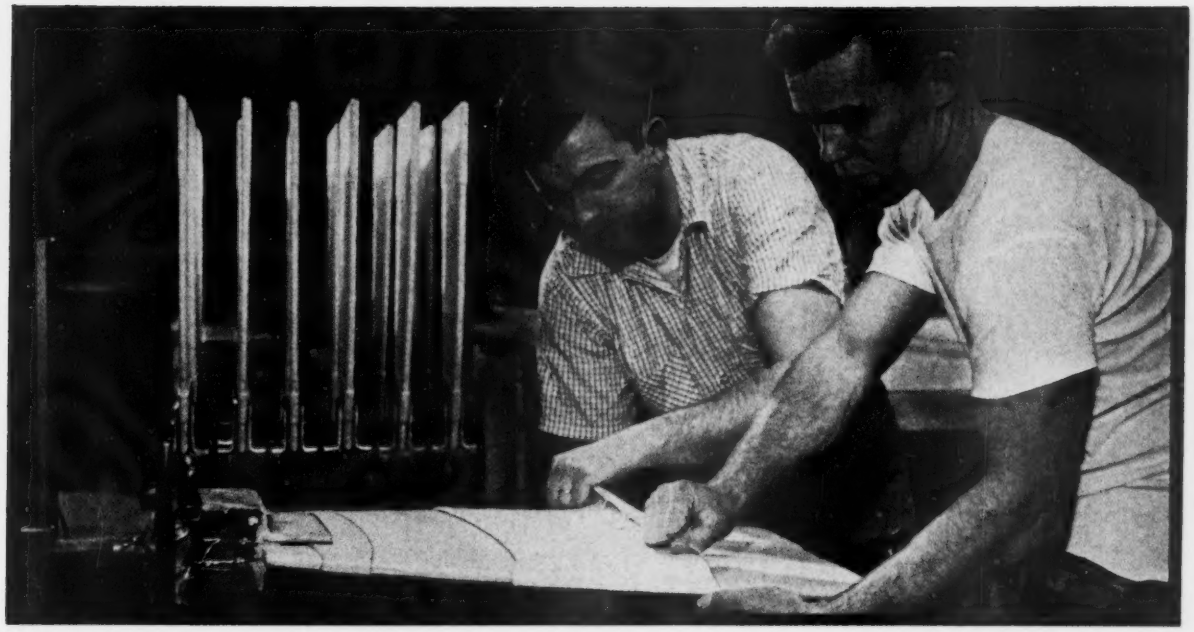

A girdle is being stripped off a phenolic dipping form cast from Marblette resin #71 at a cost of $6 as opposed to about $70 for original patterns. Additional accurate Marblette pattern duplicates, held upright in metal shoes after the girdles have been removed from them, stand by for ready reuse. Even after countless dips in liquid latex, the smooth, strong phenolic shows no sign of wear.

MARBLETTE
Phenolic Casting Resins
S-T-R-E-T-C-H
Your Production Dollars

Woonsocket Rubber and Plastic Co. is achieving mass production of hundreds of thousands of one-piece, form-fitting, ventilated latex girdles through the use of a Marblette liquid phenolic resin. Virtually unlimited quantities of exact pattern duplicates are cast to provide the many sturdy dipping forms that are needed to keep the production line moving efficiently.

This simple production improvement does not call for highly skilled or technically trained employees. You can easily test its applicability to latex dipping operations in your own plant.

Write, wire, or phone Marblette today for working samples of phenolic resin, along with production counsel at no cost or obligation.

Every detail of the original pattern is faithfully reproduced in the phenolic form shown here being removed from a steel-backed two-part vinyl mold after a short curing cycle. Speedy repetitions of the simple molding process result in as many Marblette dipping forms as mass production may require.

The Woonsocket girdle operation was described in detail in the April 1954 issue of *Rubber Age*. Use your company letterhead to request free reprints, along with Marblette's patented conversion computer which tells at a glance the kinds and amounts of casting resins and accelerators to use for producing any-sized part.

Marblette

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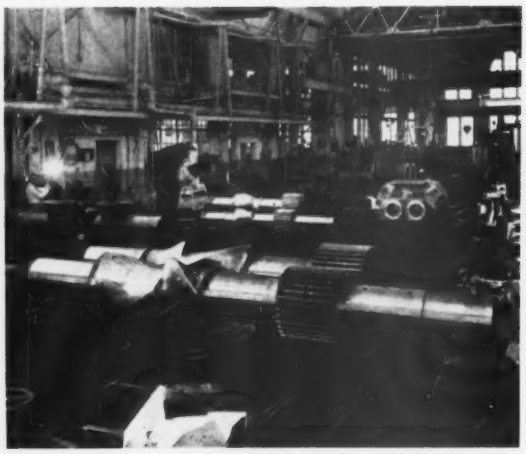

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. . . that your worn Banbury body will be returned to your line as good as new. Rotors, side jackets, rings, bearings, end frames, thrust nuts, door top, connecting gears—ALL are worked over carefully by skilled men. Each worn part is built up to its original size and contour and all wearing surfaces thoroughly hard-surfaced. New parts are used where necessary.

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1 pr. NEW #9 Banbury rotors.
1 pr. #27 Banbury steel rotors, rebuilt.
1 pr. #27 Banbury side jackets, rebuilt.
1 #27 bull gear, pinion and pinion shaft.
Also many other miscellaneous parts.

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Kosmos 70. A super black, oil base and furnace made, that boasts of the particle fineness and surface nature that tires must have to withstand fast and heavy driving.

Kosmos 70. The black that is in the front for performance in synthetic and crude rubber. Easy to mix, excellent for processing and tops for reinforcement.

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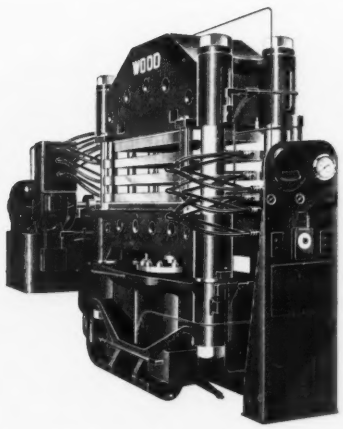

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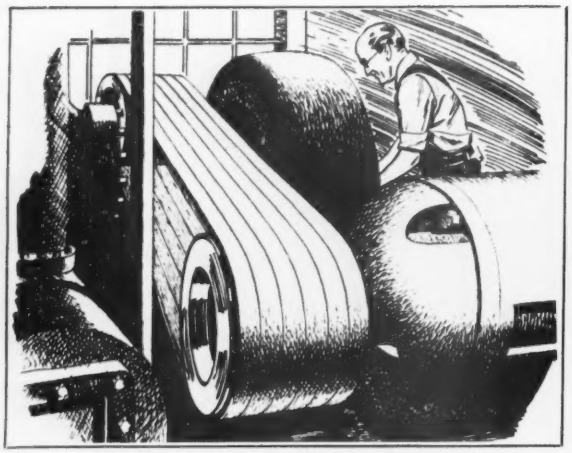
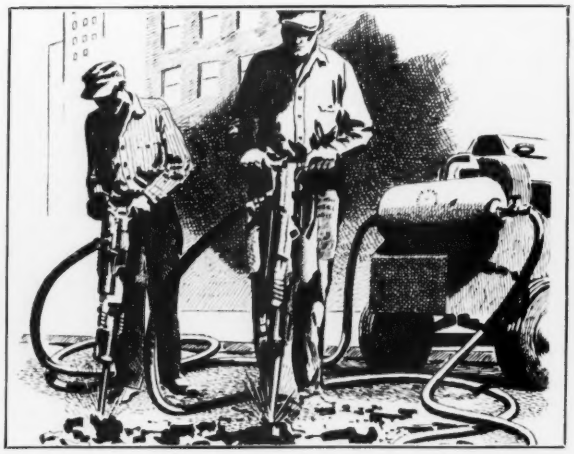


Wellington Sears has both cotton and synthetic fabrics to insure top performance and long life in products such as power transmission belts.



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Write for your free copy of "Modern Textiles for Industry" which includes pertinent information on rubber applications. Address: Wellington Sears Co. Dept. L-5, 65 Worth St., N. Y. 13.

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- Quality Controlled Throughout Every Step of Manufacture
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Cabflex Di-OA®	*di-iso-octyl adipate*	standard low temperature plasticizer
Cabflex® DOA	*di-2-ethylhexyl adipate*	standard low temperature plasticizer
Cabflex® ODA	*iso-octyl decyl adipate*	improved low temperature permanence in vinyl compounds
Cabflex® DDA	*di-decyl adipate*	new low temperature diester with low volatility and high efficiency
Cabflex® Di-OZ	*di-iso-octyl azelate*	low volatility, good water immersion properties impart excellent low temperature permanence
Cabflex Di-BA®	*di-iso-butyl adipate*	non-toxic, approved for use in vinyl food wrappings by Food & Drug Administration
Cabol 100	*hydrocarbon oil plasticizer*	low cost plasticizer, with plasticizer efficiency of 1.5; up to 50% compatibility with octyl-phthalate type plasticizers.

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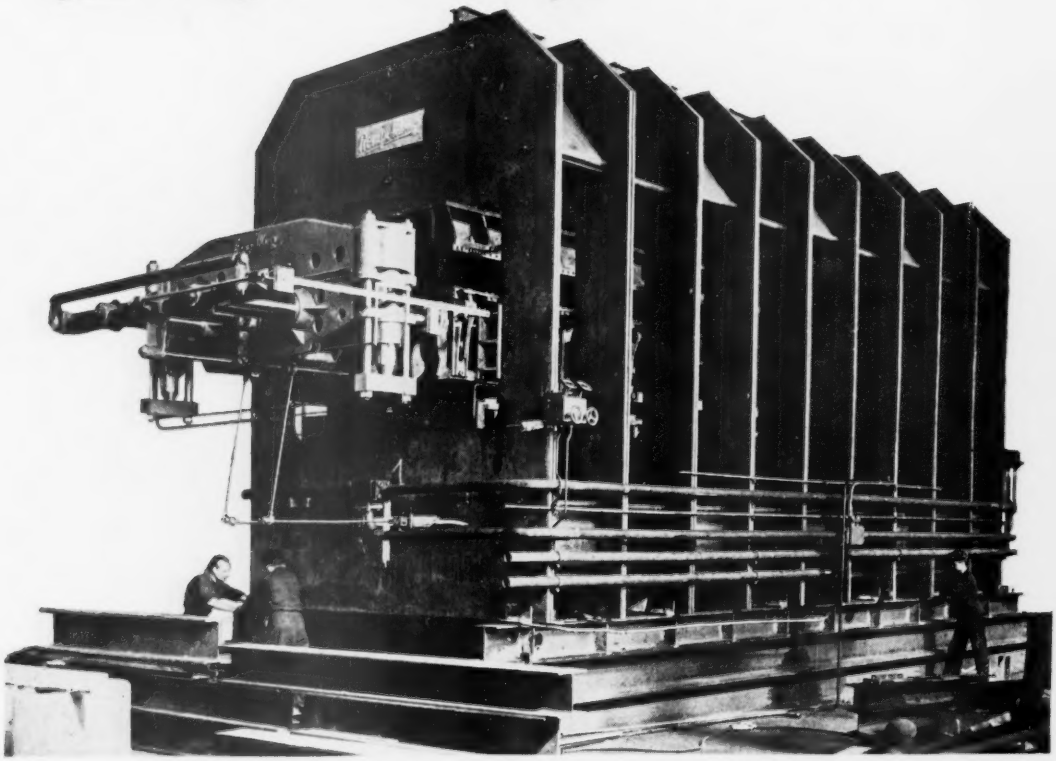
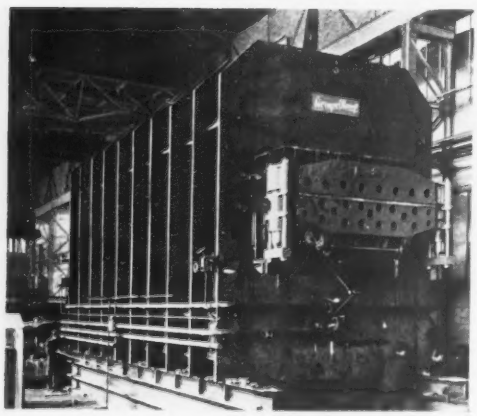


Conveyor Belt Press just completed by Siempelkamp. Hot Plates 35 feet long, 9 feet wide. Pressure 9000 tons.



Note one piece steel frame, no welded sections. Exclusive feature on plates eliminates "bumping" requirement.

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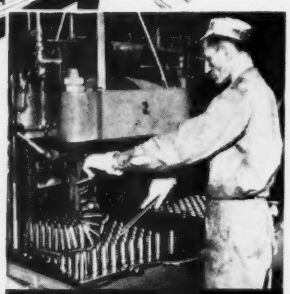
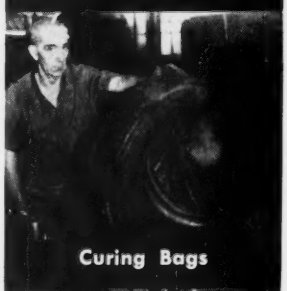
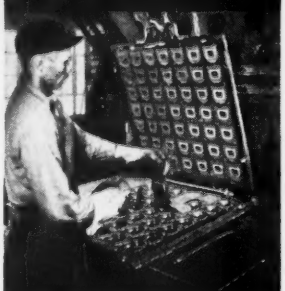


Deep Cavity Molds



Curing Bags



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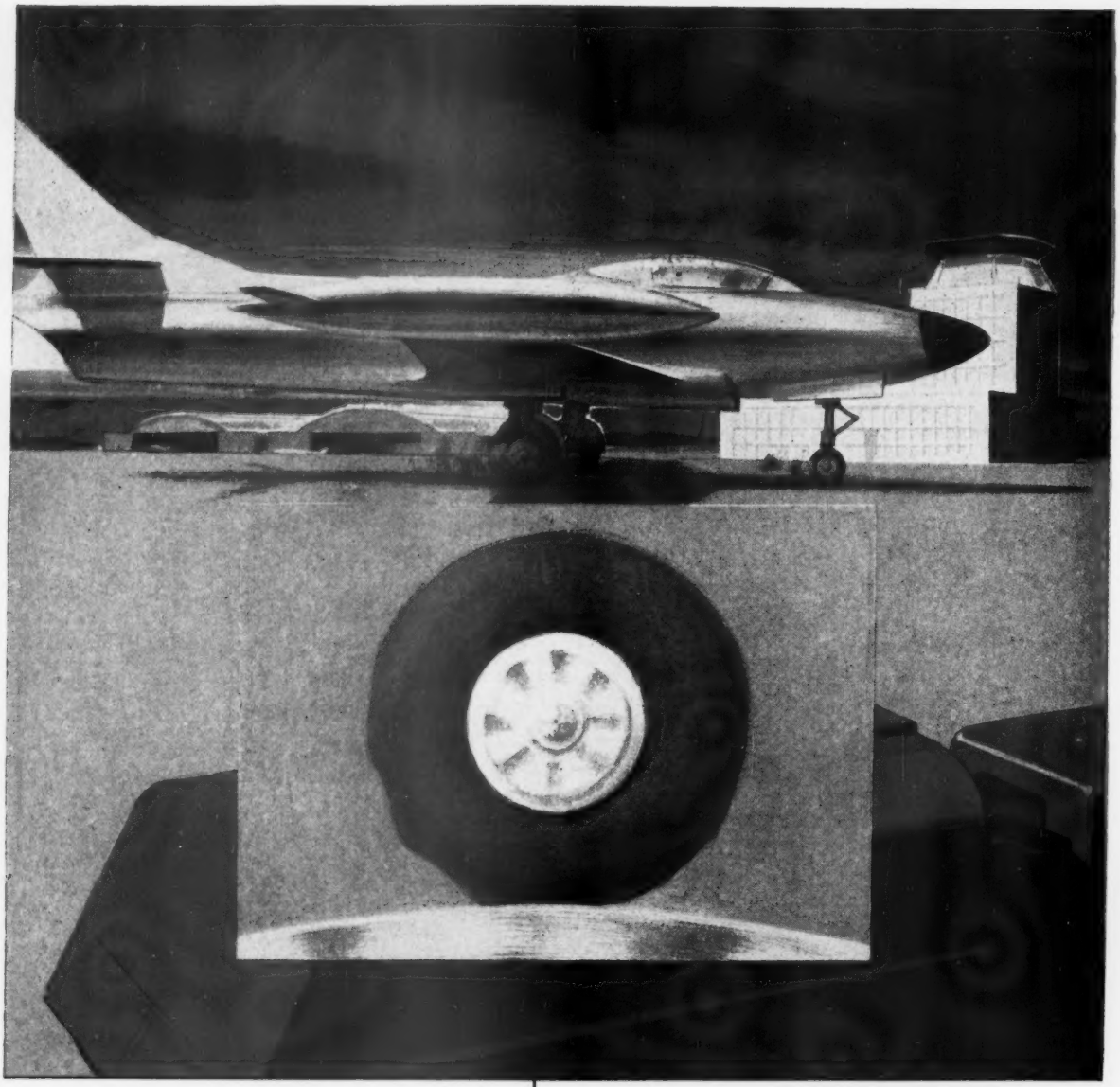

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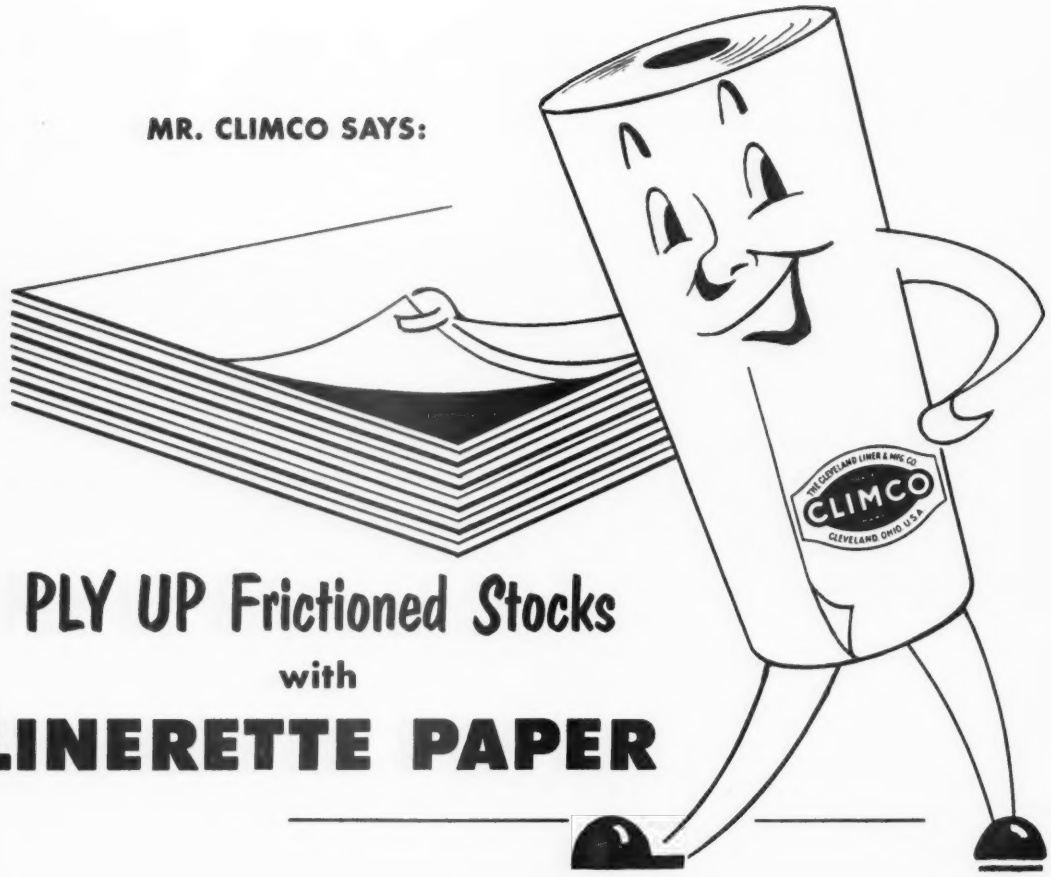

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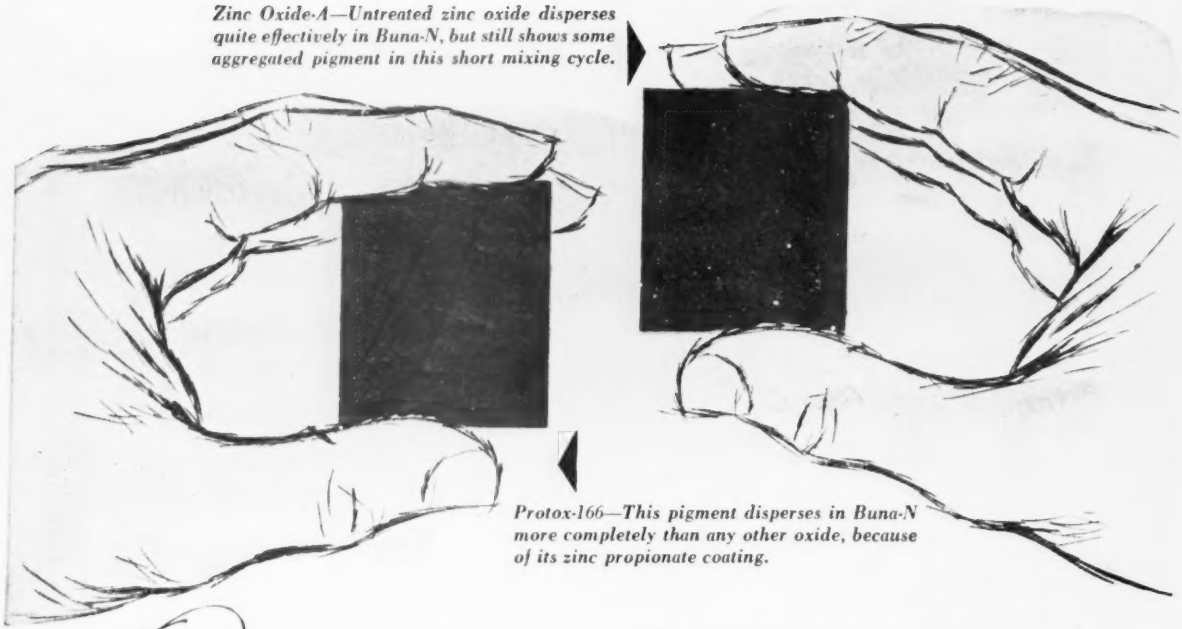

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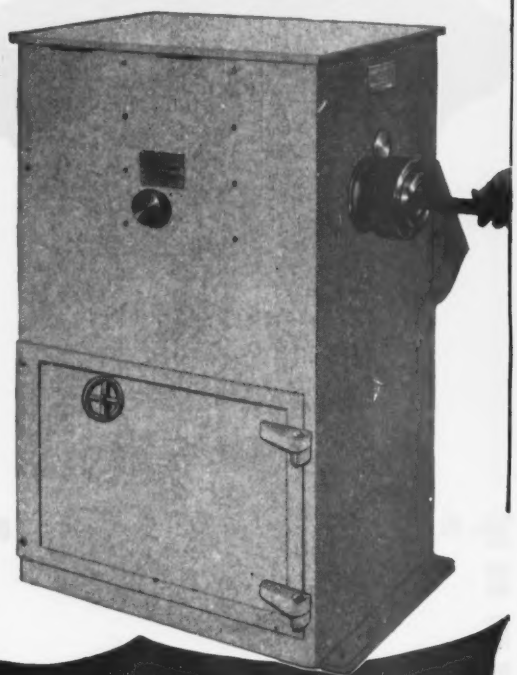

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n your plant--The HOLMES ROTARY STOCK CUTTER--will certainly minimize operating time...reduce high labor cost...and...save expensive material. Adjustable to handle stock up to 3" in diameter...cut pieces up to 3" in length...and...will cut up to 36,000 pieces an hour. Low initial cost--will quickly pay for itself.

WRITE OR WIRE FOR SPECIFIC DETAILS--regardless of your particular requirements. With 52 years know-how specializing in machinery and molds for the rubber industry--Holmes can help you solve your problems, too, just as they have for so many others. No obligation, of course.

SEND FOR ILLUSTRATED FOLDER...TODAY

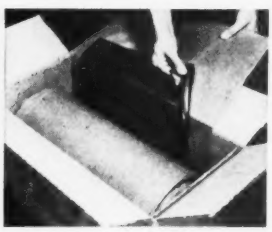
HOLMES

Successor to Holmes Brothers, Inc.

Patapar Releasing Parchments

DO THE JOB BETTER ...SAVE MONEY!

The new releasing types of Patapar Vegetable Parchment offer definite advantages over other materials as a protective packing or wrapper for tacky substances. Their dense, fibre-free surfaces release easily from a wide variety of uncured, natural or synthetic rubbers. They are effectively used as separator sheets for uncured rubber, rubber tape, and as backing for pressure sensitive surfaces.



NEVER STICKS

Some of Patapar's advantages

- Low cost
- Excellent release from tacky surfaces
- Dense, fibre-free surfaces
- Releasing qualities do not change with age
- High resistance against penetration or migration of rubber softeners and oils

Let us send you samples. Patapar Releasing Parchments come in four different types for a variety of different applications. We'll gladly send you samples of each type together with technical information. Write or wire today.

PATERSON PARCHMENT PAPER COMPANY
Bristol, Pennsylvania
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Patapar®
Vegetable Parchment
HI WET STRENGTH · GREASE RESISTING

HEADQUARTERS FOR VEGETABLE PARCHMENT SINCE 1885

NEVILLE Oils
"On Top of the Heap"
for reclaiming Rubber
LX-572
LX-777
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✓ You'll find at least one of these oils the answer in your own particular reclaiming operation.
✓ You'll get the advantage of low tailings, smooth processing, and uniformity of product, even with mixed synthetic and natural stock.
✓ Your result—a reclaim having controlled tack and improved tensile.
If you need these important qualities, you should investigate the Neville line of Reclaiming Oils. Write for information and samples.
Chemicals for the Rubber Industry
NEVILLE CHEMICAL CO.
PITTSBURGH 25, PA.
Plants at Neville Island, Pa., and Anaheim, Cal.
R-49

RELIABLE ZINC OXIDES

AZO-ZZZ-44 and AZO-ZZZ-55 assure good dispersion and easy processing because of their uniform particle size and absence of extreme fines. With AZO-ZZZ-11, 22, 33, (Acicular types) and special grades, a complete range of zinc oxides is offered for every rubber requirement.

A RELIABLE SOURCE

American Zinc assures an uninterrupted supply of zinc oxide. Recent discovery and development of a new, large ore body, added to previous American Zinc reserves, provides sufficient ore to last many years at the current rate of production.

AZO **ZZZ-44**
ZZZ-55

AMERICAN ZINC SALES COMPANY

distributors for

AMERICAN ZINC, LEAD & SMELTING COMPANY

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Solving your Carbon Black problems

in WITCO-CONTINENTAL Laboratories

Modern in every detail, the WITCO-CONTINENTAL Carbon Black Laboratory is at 1400 W. 10th Ave., Amarillo, Texas.

Our aim is always to assist you

WITCO-CONTINENTAL's Carbon Black Laboratory is devoted expressly to help you solve your carbon black problems through technical service and research. Our experienced staff utilizes the most modern methods and equipment to improve your product by finding more efficient rubber formulations.

Banbury mixer with internal temperature recorder assures homogeneous blending of every ingredient in each rubber batch under test.

Constant temperature-humidity test room contains Scott tensile strength testers. Center unit tests tensile at elevated temperatures.

Rubber mill room holds rubber mill, steam vulcanizer, exact temperature curing presses, full instrumentation for completely accurate test results.

For the complete line of Witco-Continental Rubber Blacks

Witco-Continental **CARBON BLACKS**

Recognized *for over twenty-five years* as dependable Carbon Blacks for rubber products of superior quality.

Channel Blacks

Continental® AA—Easy Processing (EPC)—Witco No. 12
Continental A—Medium Processing (MPC)—Witco No. 1
Continental F—Hard Processing (HPC)—Witco No. 6
Continental R-40—Conducting (CC)

Furnace Blacks

Continex® SRF—Natural Gas Type, Semi-Reinforcing
Continex SRF-NS—Natural Gas Type, Non-Staining
Continex HMF—Natural Gas Type, High Modulus
Continex HAF—Oil Type, High Abrasion
Continex FEF—Oil Type, Fast Extruding
Continex SAF—Oil Type, Super Abrasion

Witco-Continental's technical service staff will be glad to assist you with your rubber formulation problems.

WITCO

WITCO CHEMICAL COMPANY

CONTINENTAL CARBON COMPANY

260 Madison Avenue, New York 16, N. Y.

Akron · Amarillo · Los Angeles · Boston · Chicago · Houston
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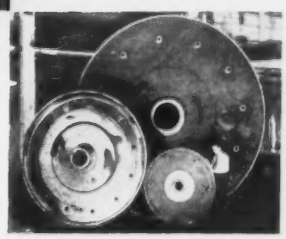
FROM Kittyhawk TO Muroc

FROM LANDING SPEEDS OF 20 MPH TO 300 MPH

This Dynamometer Bench Board controls over 200 tons of complicated precision machinery comprising an ADAMSON AIRCRAFT BRAKE AND TIRE TESTING MACHINE. On it are recorded the results of tests made at landing speeds up to 300 M. P. H.



Some Inertia Wheels used in ADAMSON AIRCRAFT BRAKE AND TIRE TESTING MACHINES. Large wheel is 16 ft. in dia.; wt. 185 tons. Peripheral speeds to 200 M. P. H. Max. Vibration .0005 to .001 inch.

ADAMSON Engineering and Testing Equipment have kept pace with Aviation progress

Adamson has designed and/or built complete, and installed, for the armed services and for commercial flying, more AIRCRAFT BRAKE AND TIRE TESTING EQUIPMENT than all other manufacturers combined. Adamson Testing Equipment is in use the world over; and Adamson Engineering is acknowledged pre-eminent in this field.

Among those Adamson serves as consultants or as designers and builders are:

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Whether you are in aviation or not, ADAMSON'S CREATIVE ENGINEERING and precision manufacturing facilities are available to you. Designing processes and building precision machinery for unusual and exacting requirements, has been Adamson's business for more than 60 years.

Your inquiry entails no obligation. Why not write today?

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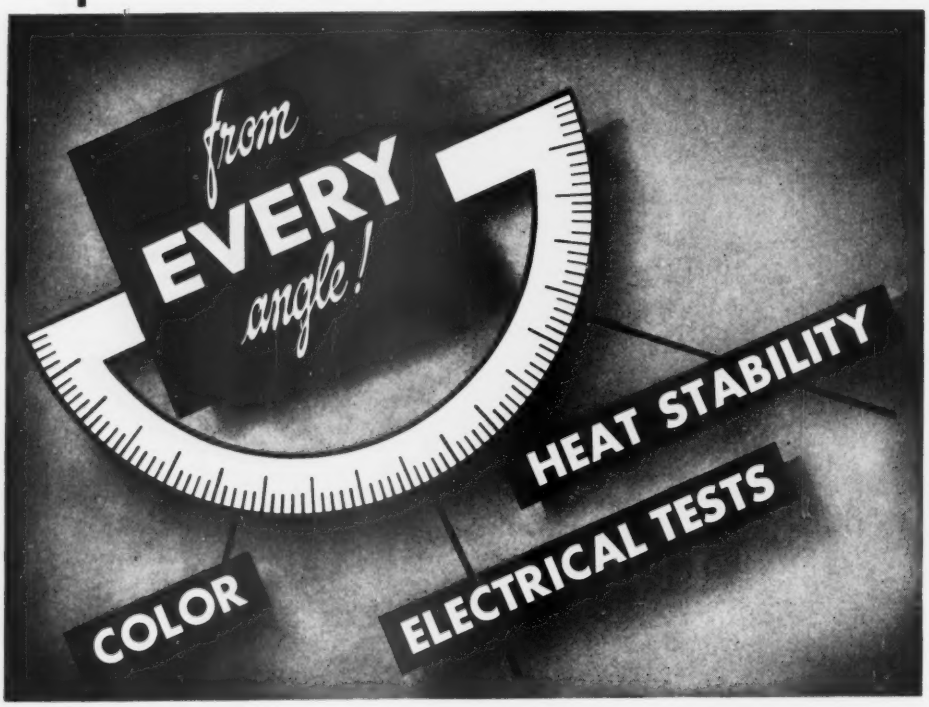

PIGMENT NO. 33

for Compounding

VINYLS AND SYNTHETIC RUBBER

Sample and technical data sent promptly on request

SOUTHERN CLAYS, Inc.

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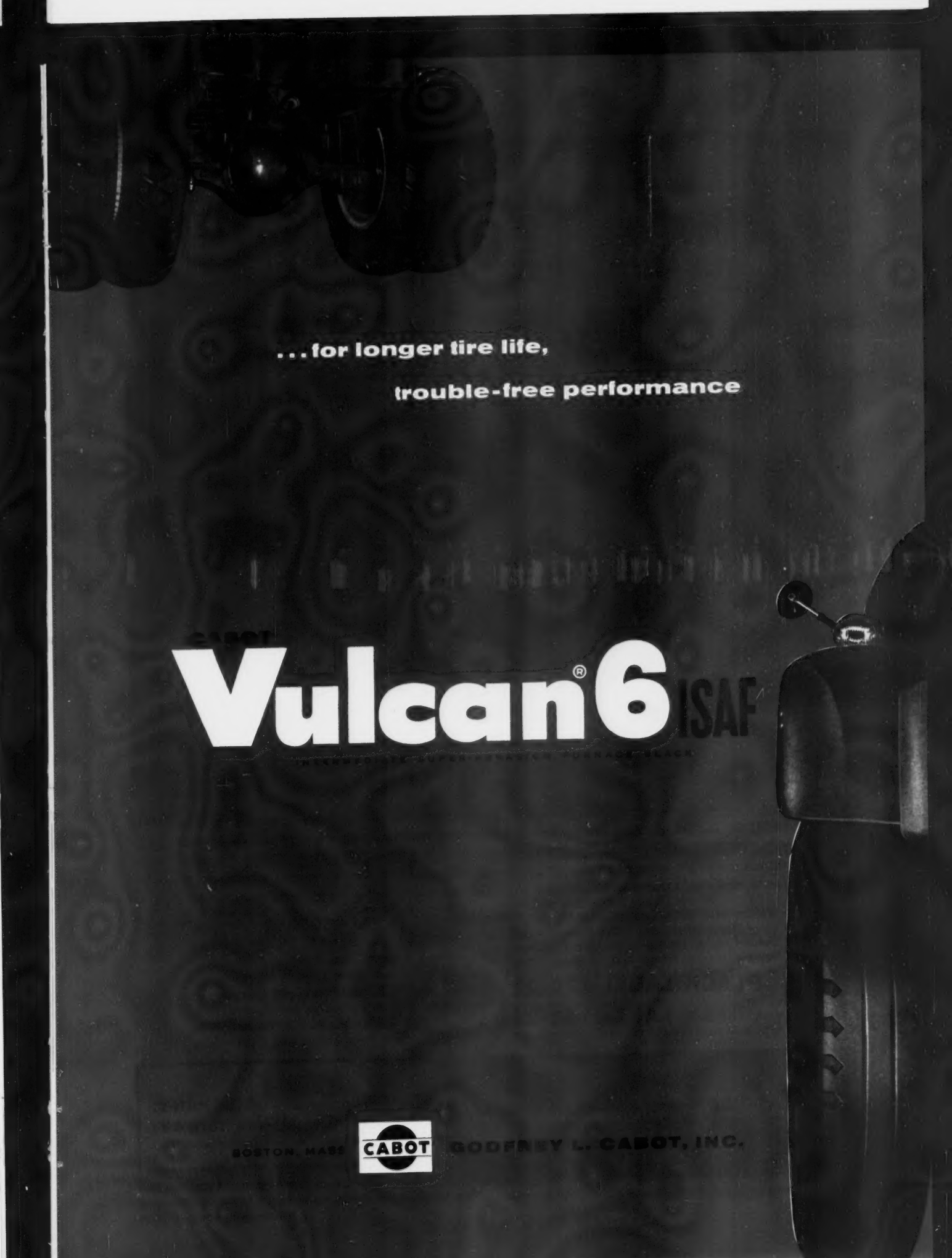
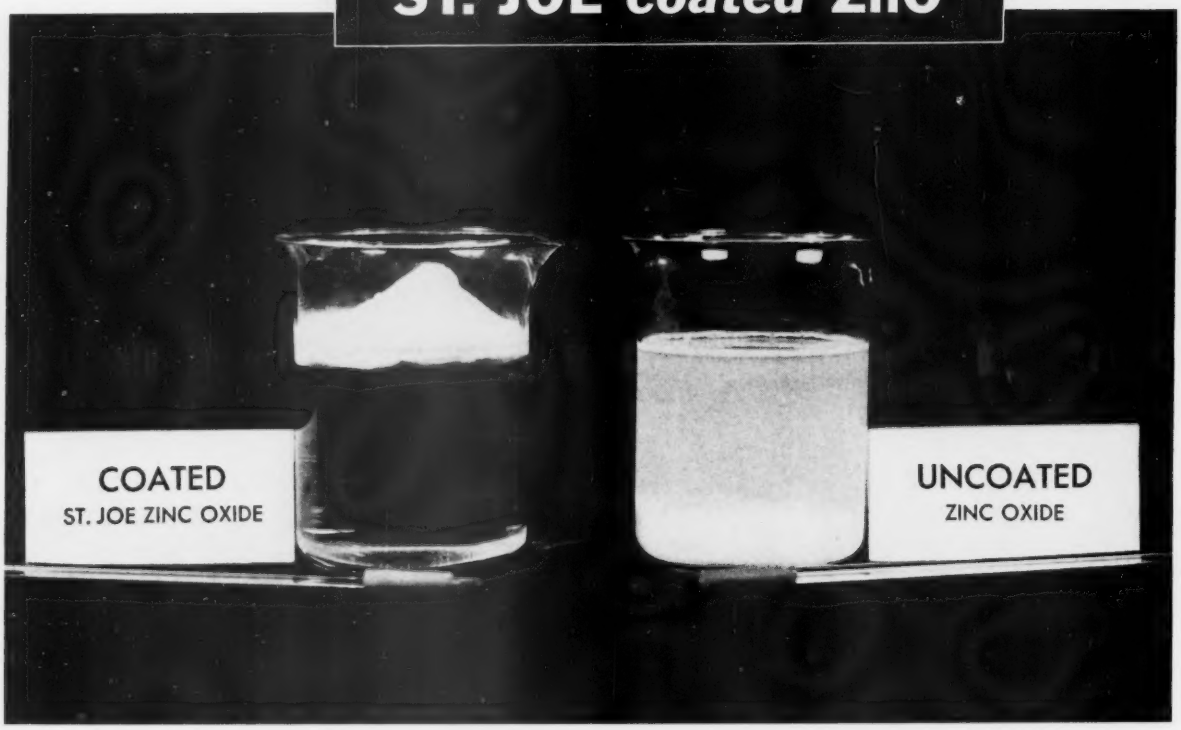

. . . for longer tire life,
trouble-free performance
CABOT
Vulcan® 6 ISAF
INTERMEDIATE SUPER ABRASION FURNACE BLACK
BOSTON, MASS.
CABOT
GODFREY L. CABOT, INC.

Maximum resistance to moisture absorption... a unique property of

ST. JOE coated ZnO



The photograph above graphically illustrates the hydrophobic nature of the surface treatment given all St. Joe coated Zinc Oxides which indefinitely resist wetting when placed in contact with water. This unique property of St. Joe coated Zinc Oxides guarantees to the consumer maximum resistance to moisture absorption during storage. Other factory-proved advantages of St. Joe coated Zinc Oxides are:

① *Faster incorporation*
② *Better dispersion*
③ *Increased mixing capacity*
④ *Lower power consumption*
⑤ *Lower mixing temperature*
⑥ *Reduced storage space*

BLACK LABEL #20-21 — **Fine Particle Size**
GREEN LABEL #42-21 — **Medium Particle Size**

ST. JOSEPH LEAD COMPANY — ST. JOE — ZINC OXIDE — JOSEPHTOWN, PA.

OUR 6-PAGE ILLUSTRATED FOLDER, CONTAINING DETAILED OPERATING DATA ON THE ST. JOE UNIT-LOAD METHOD IS YOURS FOR THE ASKING.

ST. JOSEPH LEAD COMPANY
250 Park Avenue, New York 17
Plant & Laboratory: Monaca (Josephtown) Pa.

THIS HOT SPRAY GIVES CORROSION A COLD SHOULDER

THE photograph above shows a very important operation in the manufacture of aluminum insert tire molds in our Athens, Ohio plant.

Wherever an aluminum insert is to be used the cavity is sprayed with molten aluminum to provide a positive means of preventing electrolytic corrosion of the insert. This spray coat of molten aluminum forms an integral bond with cast iron, cast, forged or welded steel . . . avoids the contact of aluminum inserts with a dissimilar metal.

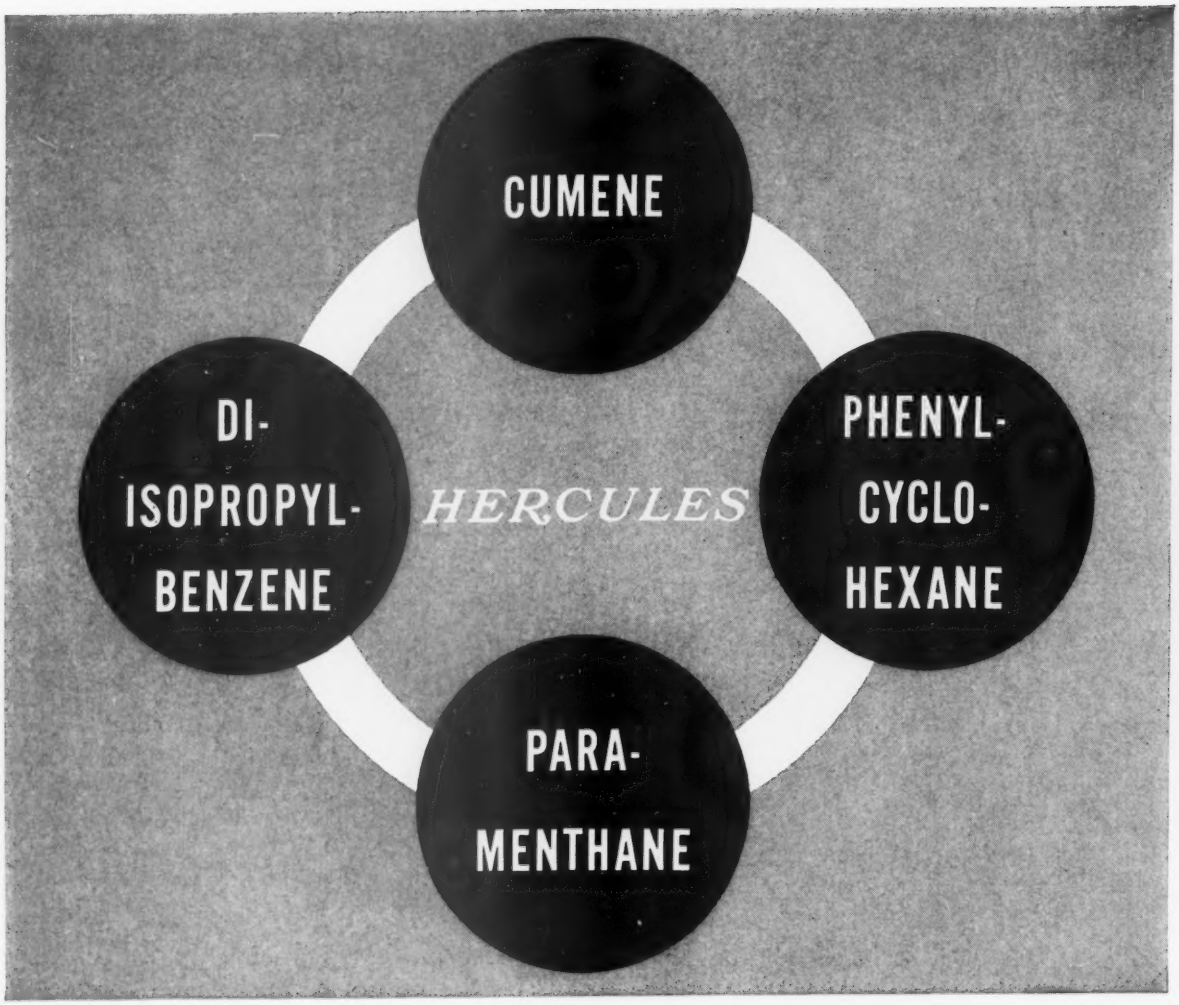
Metalizing is typical of the care with which we approach every step in the making of tire molds. Our plant at Athens is, we believe, the only plant in the world devoted exclusively to tire mold manufacture. Here, specialized machines and machine tools (many of our own design) and craftsmen thoroughly skilled in their use, produce tire molds of superlative quality — and at decidedly favorable cost.

ATHENS MACHINE DIVISION

THE BRIDGWATER MACHINE COMPANY

Akron, Ohio

FOR BETTER MOLDS FOR BETTER TIRES *SPECIFY* BRIDGWATER



HEADQUARTERS FOR HYDROPEROXIDES

A pioneer in the screening and development of polymerization catalysts, particularly for cold GR-S, Hercules has an intimate knowledge of all available types. Whether your needs can be met best by one of the four Hercules hydroperoxides now in common use or by an initiator especially developed to your specification, Hercules' experience in this field is at your disposal.

HERCULES POWDER COMPANY

918 Market St., Wilmington 99, Del.

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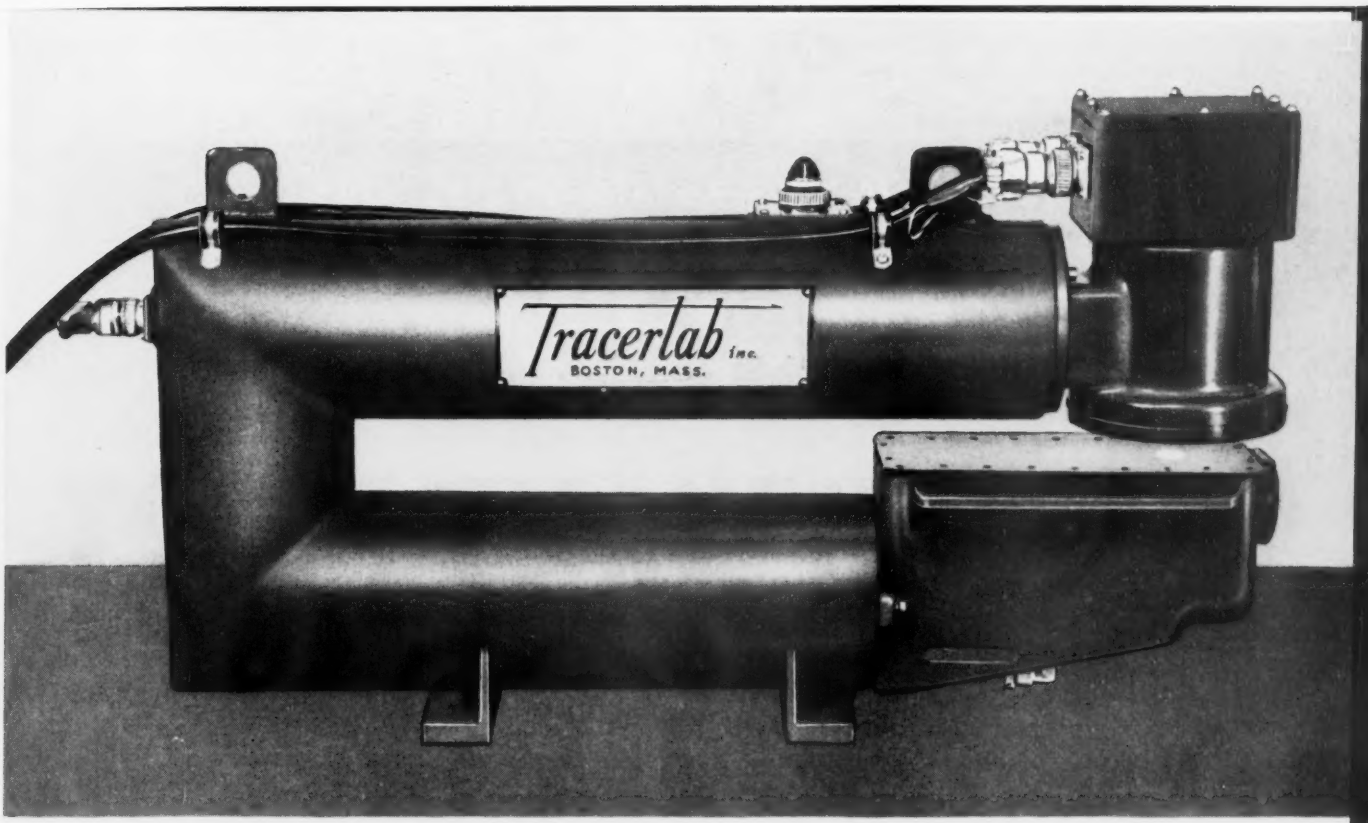

Here's the NEW

CESIUM-137 BG-5 LIGHT MATERIALS BETA GAUGE

Designed specifically for those mills producing light materials

Mills running light, critical materials may now use Beta Gauges to insure better product uniformity, cut raw material costs, and increase production. Tracerlab — the firm that made the first Beta Gauges — has licked the problem of using Cesium-137 as a source material. Its long-life, low energy beta rays make possible *for the first time* the gauging of the lightest materials with unexcelled stability and accuracy. Into the design and production of the new BG-5 have gone all the skills and knowledge amassed through the production and sale of the large majority of all beta gauges now in use. The BG-5 will enable you to:

- **Cut raw material costs by running closer to minimum tolerance.**
- **Increase production by producing more first quality product.**
- **Enable you to get "on gauge" quicker, thus reducing wastage and off-goods.**
- **Improve quality by maintaining production standards. Continuous inspection vs. unreliable "spot" checking.**
- **Recorder accessory provides 24-hour production record of material variations.**

The BG-5 Light Materials Beta Gauge can be used in automatic control arrangements; can be obtained with a variety of recorders; is equipped with a "C" frame having a throat depth to meet your requirements; has "all-angle" scanning mounts that provide across-the-sheet profiles.

Here's the answer to your control and quality problems . . . at a cost that any mill can afford. The details await your request.

GET THE FACTS NOW!!! There's a Tracerlab Beta Gauge direct-factory representative in your area waiting to demonstrate a gauge and tell you the full story of how the BG-5 can save you money. Write today to arrange a visit, and to get further information. Tracerlab, Inc., 131 High Street, Boston 10, Massachusetts.

Tracerlab® inc.
BETA GAUGE

WHAT DO YOU WANT MOST FROM A PROCESS AID?

Better physicals, lower cost, processing ease—or the best combination of the three? The combination, of course. That's where Sun comes in. From its *complete* line, you can select the one process aid that will give you a finished product meeting specifications and costing the minimum to produce. For more information, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. RA-7.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO

PHILADELPHIA 3, PA. ◆ SUN OIL COMPANY LTD., TORONTO & MONTREAL

COLORED BUTYL RUBBER COMPOUNDS

RECIPES

	A	B	C
GR-I 15 (Butyl Rubber)	100	100	100
Zinc Oxide	5	5	5
Hi-Sil® 202	39	58.5	40
Calcene® NC	.....	.....	40
Soft Clay	.....	.....	40
TMTDS	2	2	2
Sulfur	1	1	1
Sulfasan®	1	1	1
Paraffin	0.75	0.75	0.75
Diethylene Glycol	1.5	1.5	1.5
BxDC	1	1	1
Color and TiO_2	As Required		

PHYSICAL PROPERTIES

Mins. Cure at 320° F.	Modulus 300%	Modulus 500%	Tensile	Elong.	Hardness 0"	Hardness 30"	Crescent Tear
COMPOUND A							
7.5	180	530	2650	800	59	45	270
10	180	550	2550	780	62	47	270
15	210	680	2580	760	63	49	270
20	230	700	2510	730	66	50	250
30	240	670	2540	740	66	50	240
COMPOUND B							
7.5	180	470	2240	910	70	57	380
10	200	610	2240	860	72	62	350
15	260	700	2240	810	74	62	350
20	290	750	2240	800	76	66	310
30	340	950	2080	720	77	67	300
COMPOUND C							
7.5	280	680	1690	760	76	57	300
10	300	680	1650	720	76	60	290
15	340	870	1740	700	77	61	270
20	330	810	1530	670	82	63	240
30	380	890	1570	660	82	62	260

At last!

COLORED BUTYL COMPOUNDS POSSESSING GOOD PHYSICAL PROPERTIES

HI-SIL 202

With Hi-Sil 202, it is now possible to make good white or colored butyl compounds.

In addition to excellent physical properties, Hi-Sil 202 provides cures without subsequent sulfur bloom by use of an improvement in compounding shown in the listed formulation.

This application of Hi-Sil 202 opens up broad new opportunities to utilize the sales advantages of attractive bright or pastel colors in molded goods or extruded parts.

Write today to our Pittsburgh office for further information on Hi-Sil 202, or for experimental working samples.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
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New product news for paper coaters:

MONSANTO Opalon® 410

STIR-IN VINYL RESIN

Your key to quality plastisol coatings and the bigger markets they open

Opalon 410, Monsanto's new stir-in vinyl plastisol resin, joins the growing list of chemicals and plastics made by Monsanto for the aggressive, creative paper specialty industry.

If you manufacture coated papers for luggage, shoe findings, leather notebooks, and other applications, it will pay you to investigate the wide range of product and production advantages that research-developed Opalon 410 delivers. These include:

Easy compounding: a simple stirring process that requires no expensive equipment.

Outstanding durability: becomes a part of the finished manufactured item, providing the degree of strength and durability, the resistance to abrasion and wear that your product must have.

Good resistance to greases, oils, water, detergents, and discoloration caused by sunlight.

Wide color range of imitation leather and other embossed and decorated effects is easily achieved.

Monsanto invites you to investigate the benefits that Opalon 410 vinyl resin will contribute to your coated papers line. For full particulars, write: MONSANTO CHEMICAL COMPANY, Plastics Division, Room 6901, Springfield 2, Mass.

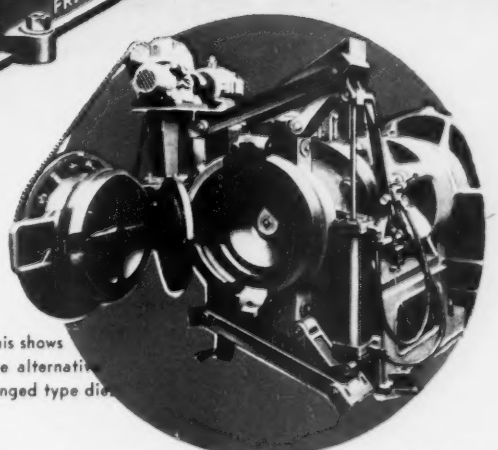
Opalon: Reg. U. S. Pat. Off.

MONSANTO

SERVING INDUSTRY... WHICH SERVES MANKIND

for efficient straining of raw rubber, mixed stock and reclaim

Shaw heavy duty strainers are designed for the straining of raw rubber, mixed stocks, reclaim, etc., and are available with screws of 6", 8" or 10" diameter. The straining head is of the end delivery type arranged on sliding bars, and the locking and unlocking gear is hydraulically operated by means of a self-contained motor-driven pump. We shall be pleased to forward an illustrated leaflet describing these machines in detail.



This shows the alternati... hinged type di...

Industry's headquarters for the best in Rubber and Plastic machinery

SHAW **HEAVY DUTY STRAINERS**

FRANCIS SHAW & COMPANY LIMITED MANCHESTER 11 ENGLAND

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FRANCIS SHAW (CANADA) LTD., GRAHAMS LANE, BURLINGTON, ONTARIO, CANADA.

IF IT'S BIG, NEW OR

BIG

This huge, size 27 Banbury* mixer, weighing over 125 tons, with a Uni-drive for 1500 HP or more, is designed for plants having sufficient capacity to absorb its immense output. It has a batch capacity of 1,000 pounds of 1.50 specific gravity stock, or an output equivalent to twelve to fifteen 84" mills. Built for heaviest duty, the size 27 is capable of continuous day-and-night service. Greater centralization of operations in one unit results in correspondingly greater savings in labor, supervision, preparation and handling of materials, and still other economies. This machine will take, in one batch, three whole, undivided bales of crude rubber and disintegrate and masticate them to the desired degree of plasticity, thus saving the time and expense of preparing or cutting up the rubber.

Between the laboratory Banbury, the smallest of the line, and the size 27 are five other sizes of various capacities, permitting the selection of the right machine to suit individual requirements.

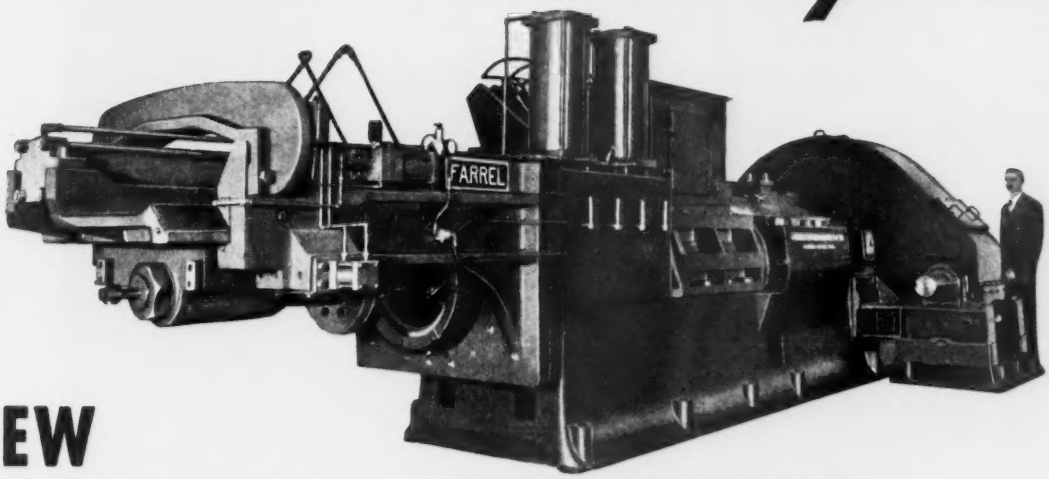
*Trade-mark.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONN.
Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston.

Farrel-Birmingham

DIFFERENT, IT'S PROBABLY

Farrel-Birmingham®



NEW

This 20″ extruder, which takes the output of the size 27 Banbury, is the latest design of heavy-duty extruder developed by Farrel-Birmingham. Operation is fully automatic. Adequate cooling is provided so that the temperature of most stocks when discharged from the extruder is no greater than when received from the Banbury mixer. The machine extrudes through a circular die and the stock is slit at the die exit to form a continuous slab, about 60 inches wide, which can be cut to desired lengths.

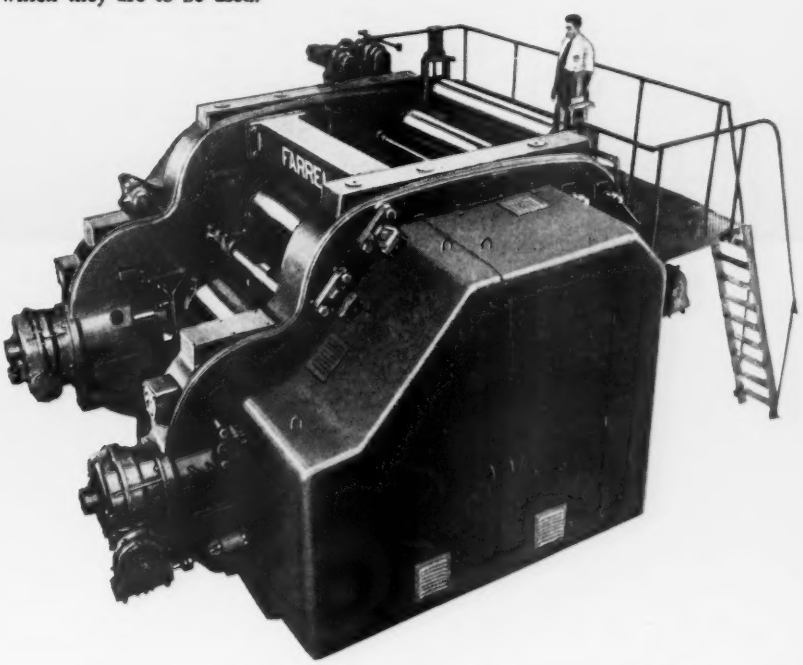
Large size extruders provide the answer to full utilization of short-cycle operation of large capacity Banbury mixers. The bottleneck of a group of milling operations following Banbury processing is eliminated, together with all manual handling connected with milling. Flow of material is accelerated and simplified; also the plasticity of stock worked by the screw in a single pass in the extruder chamber is more uniform than that of milled stock.

Extruders are made in various sizes to match the capacities of the Banburys with which they are to be used.

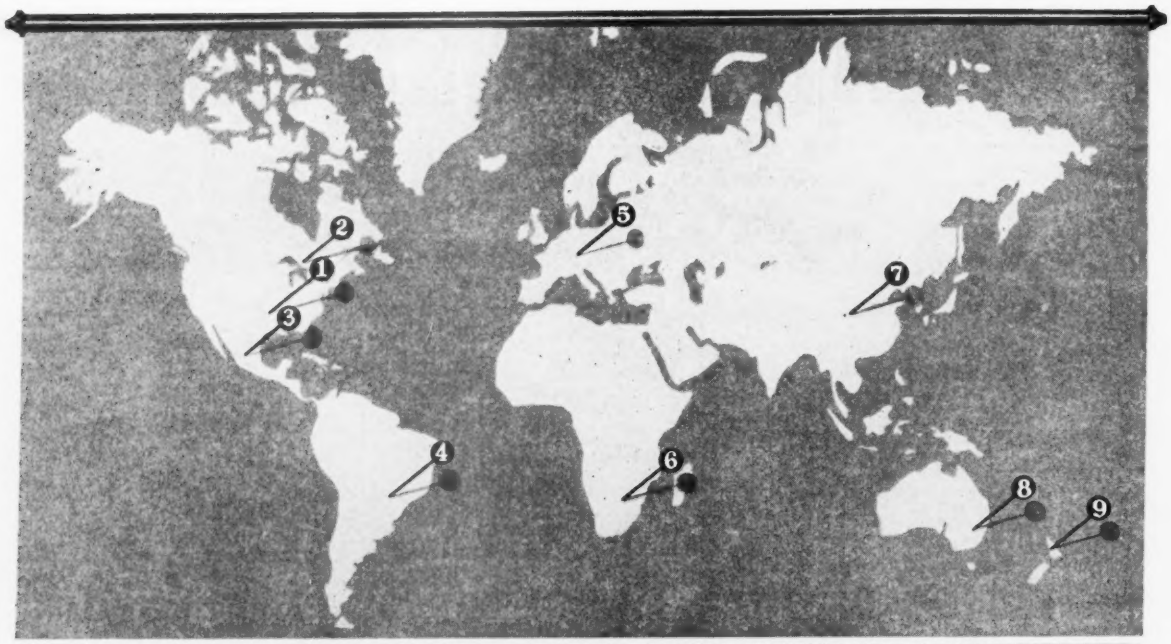
DIFFERENT

The origination and development of the four-roll "Z" calender by Farrel-Birmingham eight years ago was the most significant advance in calender design since this company first built calenders for the rubber industry in 1854. The remarkable performance of these machines has established new standards for accuracy in calendering both rubber and plastics products. They have proved equally outstanding in the production of film and sheeting and for coating.

Farrel-Birmingham calenders are made in various types and in a wide range of sizes, from small 6″ x 13″ units for the laboratory, up to the largest production machines. They are furnished with two, three, four or more rolls, and with the rolls in a number of different arrangements.



FB-931



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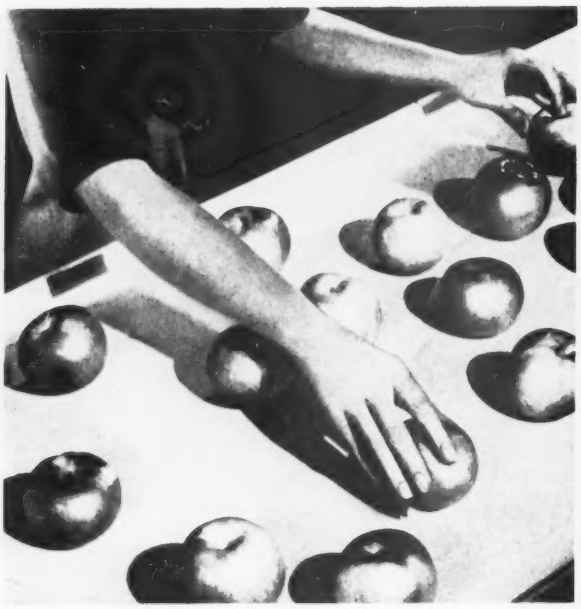

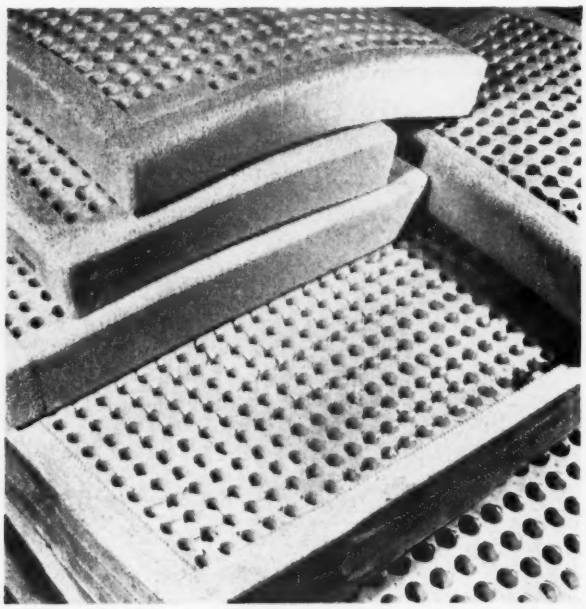

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RUBBER AGE

Vol. 75, No. 4 JULY, 1954

Report From London . . .

Third Rubber Technology Conference

By M. E. LERNER
Editor, RUBBER AGE

LONDON, June 26—The Third Rubber Technology Conference to be held under the auspices of the Institution of the Rubber Industry has just been concluded. It was held at the Church House in Westminster, London, England, on June 22, 23, 24 and 25, and in every sense was a definite improvement over the previous two international conferences sponsored by the Institution. These conferences, first organized in 1938, were scheduled to be held every five years, but unfortunately the war disrupted the conference which was to be held in 1943. This conference was eventually held in 1948. The conference scheduled for 1953 was delayed until this year due to the coronation of Queen Elizabeth.

The latest conference, as indicated, was larger in almost every respect. For example, official registration of participating delegates amounted to 697 as compared with 664 in 1948; a total of 50 papers was presented as against 43, and 19 countries were represented as against 15 at the previous conference. Seventy-one separate organizations were represented at the 1948 Conference as compared with an estimated 95 at the one just concluded. It should also be pointed out that whereas the previous conferences made no special provision for lady guests, the 1954 conference included a comprehensive and exceedingly well-planned program for ladies, and a total of 87 were registered. Some 30 students from various colleges and universities were also in attendance.

The conference was officially opened on Tuesday morning, June 22, by the Marquess of Salisbury, patron of the Institution of the Rubber Industry, who was introduced by Lord Baillieu, head of the Dunlop Rubber Co., Ltd., and president of the Institution. The Marquess extended an official welcome to the delegates on behalf of Her Majesty's Government, particularly to those from overseas. He expressed the hope that the latter delegates would not only benefit from their visit in a technical sense, but would "form friendships which may prove enduring and fruitful long after the end of the conference." He added the hope that such friendships will benefit "not only the cause of rubber, but also that of international understanding." Lord Baillieu thanked the Marquess for the interest which the British Government took in the Conference, and then turned the meeting over to Dr. W. J. S. Naunton, formerly head of the Rubber Service Department of Imperial Chemical Industries, Ltd., who functioned as Chairman of the conference.

Shown above is the Marquess of Salisbury, patron of the Institution of the Rubber Industry, officially opening the Third Rubber Technology Conference. Seen at the left is Lord Baillieu, president of the Institution.

The Rt. Honorable Lord Bailieu, president of the Third Rubber Technology Conference

Conference Sessions

The conference sessions themselves were held every morning and afternoon, and differed from those at the previous conferences in that they were continuous, with only one session held at a time. In 1948, two or more sessions were held concurrently, with the result that it was not always possible for a delegate to hear all of the papers in which he was directly interested. It was generally agreed that the present system was a major improvement and would be followed at future conferences. Another noted improvement was the fact that each author was permitted to give a 10-minute summary of his paper, including the presentation of key slides, followed by discussion. In 1948, only discussion—written and spontaneous—was permitted. It is a tribute to the session chairmen and the authors that the 10-minute periods were carefully observed.

The papers at the conference were divided into seven major sections as follows: (1) Properties of Natural Rubber Latex; (2) Production and Evaluation of Synthetic Rubber; (3) Chemistry of Rubber; (4) Physics of Rubber; (5) Developments in Testing Methods; (6) Compounding: Theory and Practice; (7) Miscellaneous Technology. Special chairmen presided at each session as follows: *Natural Rubber Latex*—E. A. Murphy (Dunlop Rubber Co., Ltd.); *Synthetic Rubber*—Dr. W. J. S. Naunton; *Chemistry of Rubber*—Dr. L. C. Bateman (British Rubber Producers' Research Association); *Physics of Rubber*—Dr. J. R. Scott (Research Association of British Rubber Manufacturers); *Testing Methods*—J. M. Buist (Imperial Chemical Industries, Ltd.); *Compounding*—Dr. D. Parkinson (Dunlop Rubber Co., Ltd.); *Miscellaneous*—Dr. J. G. Mackay (Avon India Rubber Co., Ltd.). Deputy chairmen, in the same order, included: E. W. Madge (Dunlop), Dr. J. T. Watts (I.C.I), Dr. W. C. Davey (Dunlop), L. Mullins (B.R.P.R.A.), M. Heywood (P. B. Cow & Co., Ltd.), and L. E. Masheter (Dunlop). Mr. Mullins acted as deputy chairman for both the sessions on physics and testing developments.

It is extremely difficult to analyze the presentation of 50 technical papers and to decide which contains the more important data. Some idea of the scope of these papers is indicated in the brief abstracts appended to this report. It was generally agreed, however, that the work on "graft polymers" reported by the British Rubber Producers' Research Association, which was presented by Dr. G. F. Bloomfield, was of major interest. In this report, it was indicated that graft polymers of styrene and methyl methacrylate with rubber can be readily compounded and cured to give light-colored articles of good tensile strength. The flex-cracking and fatigue resistance of rubber-methyl methacrylate graft polymers were reported to be especially outstanding. The price and availability of both styrene and methyl methacrylate, the ease of polymerization, the clearly-defined nature of the products, and the technical properties of the vulcanizates combine to indicate that these modified rubbers give promise as new materials for technical application.

It is interesting to note that the paper on graft polymers was included in the session devoted to the production and evaluation of synthetic rubber. In a sense, it can be attributed to a determination by natural rubber producing interests to offer a series of tailor-made natural rubbers to meet the competition of the tailor-made synthetics. This is a most understandable effort and one which industry in general should welcome, since it gives them a still greater choice of basic raw materials.

In opening the session devoted to synthetic rubber, which took all of one afternoon and all of the following morning, Dr. Naunton, who presided, remarked that until recently the synthetic rubbers held only an academic interest in England, but the inclusion of nine papers on this subject at the conference was indicative of a growing interest in England and the Continent in the synthetics generally. Most delegates at the conference were aware of the fact that a synthetic rubber industry in England will be a reality in 12 to 16 months, since plans for the production of various types of synthetics have already been announced by Dunlop Rubber, Imperial Chemical Industries, and Monsanto Chemicals, Ltd.

Other papers at the synthetic rubber session included an evaluation of both dry and latex types, latest developments in the Alfin polymers, a report on a new class of oil-resistant synthetics termed pyridinium high polymers, rubbery copolymers from unsaturated ketones, determination of oil resistance over an extended period of time, preparation of condensation block polymers, and some interesting data on the structure and solution properties of high styrene-butadiene copolymers. An interesting demonstration of "bottle polymerization" was given by Professor A. A. Morton (Massachusetts Institute of Technology) in connection with his talk on the Alfin reagents.

W. J. S. Naunton, chairman of the Third Rubber Technology Conference

Data at Other Sessions

Eight papers were included in the session devoted to natural rubber latex, which was actually the first one held at the conference. Four of these covered work being caried out solely with fresh latex at the plantations, including peptization, variability and deproteinization. Stability of ammoniated latex was the subject of another paper, and the zinc oxide testing of latex still another. A paper on micro gel in latex and sheet rubber received a good deal of attention.

The session on chemistry, which included seven papers, reflected the never-ending work which is being carried on to learn more about the peculiarities of the materials with which the industry works. Two of the papers at this session reported recent investigations of the reactions between rubber and oxygen, another covered the behavior of highly-filled rubber vulcanizates, and a fourth was devoted to the structural characteristics of the sulfur linkage in natural rubber vulcanizates. Considerable interest was aroused by the report from the Atomic Energy Research Establishment, similar to the Atomic Energy Commission in the United States, which described the behavior of rubber when exposed to high energy radiations. Other papers at this session covered the infra-red spectroscopic analysis of elastomers and chemical reactions of some of the antioxidants used in compounding.

The eight papers presented at the session on physics of rubber also demonstrated the tireless work being performed in laboratories all over the world to secure a better understanding of rubber and its reactions. Of special interest at this session was a report on natural rubber compounds capable of performing at lower temperatures than the present commercial compounds. This work, conducted by the British Rubber Producers' Research Association, covered an extensive investigation with numerous plasticizers, and was stated to have resulted in practical compounds of natural rubber having various hardnesses with low temperature characteristics approaching those of the special low temperature types of inorganic elastomers coupled with markedly superior physical properties.

Another interesting paper scheduled for this session, which regrettably was not presented in person, covered a study of rubberlike polymers by nuclear magnetism. This work represents an entirely new approach to an investigation of the structure and properties of rubberlike materials in general, and the principles involved will undoubtedly be given a good deal of attention for months and years to come. Other papers at the physics session included work done on the dynamic properties of rubber, modifications of the permeability of natural rubber vulcanizates, time dependent effects in tire cords, the elasticity of "ideal" and "real" rubberlike materials, and a discussion of a theoretical model for the elastic behavior of filler-reinforced vulcanized rubbers. The subject of reinforcement, tear strength and anisotropy was also covered.

As was to be expected, the session devoted to the theory and practice of compounding attracted a capacity audience. Eight papers were given at this session, and had it not been for time limitations the discussions following the presentations, particularly that devoted to reinforcement, could easily have continued into the afternoon and night. Several of the papers were directed to securing a better understanding of the principles underlying the reinforcement of rubber by carbon black, two of these maintaining that the bond between rubber and black is chemical in nature and a third devoted to the importance of particle size and diameter of the black. The reinforcement characteristics of lignin and various resins in natural rubber compounds were covered in additional papers.

Of exceptional interest at the compounding session was a paper covering the quality of levels of various types of blacks, their roles and applications, their performance at increased loadings, and their effects in tire tread and tire body stocks. This paper was truly "international" in concept in that it covered not only blacks prepared in the United States and England, but also those produced in Canada, Germany, Japan, Czechoslovakia, and Roumania. What was even more surprising was that the author (Dr. I. Drogin, United Carbon Co.) was able to cover the highlights of this comprehensive review in the allotted 10-minute period.

Other papers presented at this session included one on the Mooney viscosity of carbon black-rubber mixtures, which represented a rheological approach to the study of reinforcement, and another on the oil extension of natural rubber. The latter report, prepared by the famed

Delegates from the United States Present at the Third Rubber Technology Conference

London, June 22, 23, 24, 25, 1954

B. C. Barton, U. S. Rubber Co.
John T. Blake, Simplex Wire & Cable Co.
E. R. Bridgwater, E. I. du Pont de Nemours & Co.
S. M. Cadwell, U. S. Rubber Co.
L. D. Carver, Witco Chemical Co.
J. W. Crosby, Thiokol Chemical Corp.
E. M. Dannenberg, Godfrey L. Cabot, Inc.
A. R. Davis, American Cyanamid Co.
I. Drogin, United Carbon Co.
B. W. Henderson, American Cyanamid Co.
A. E. Juve, B. F. Goodrich Co.
M. E. Lerner, *RUBBER AGE*
A. A. Morton, Massachusetts Institute of Technology
I. D. Patterson, Goodyear Tire & Rubber Co.
W. B. Reynolds, Phillips Chemical Co.
W. R. Smith, Godfrey L. Cabot, Inc.
M. L. Studebaker, Phillips Chemical Co.
Leon Talalay, Sponge Rubber Products Co.

G. E. Holmes-Siedle, secretary of the Institution of the Rubber Industry

Rubber-Stichting at Delft, was devoted largely to oil-extended natural rubber for tire treads, and it was shown that the softening effect of oils in such treads can be counterbalanced by increased loadings of black. Road tests were said to indicate that results comparable to non-extended rubber tires were possible. Actual tires recapped with oil-extended natural rubbers were on exhibit during the conference.

Several new testing procedures and at least two new instruments were described and illustrated at the session devoted to developments in testing methods. Latest developments in the testing of tires were outlined, a new tear-down adhesion machine was described, methods of determining the fatigue of tire cord were illustrated, and a relatively new constant power principle for abrasion testing was discussed. The latter principle was reported to bring the abrasion tester closer to actual service conditions than previous testers. A test for determining the changes of electrical resistance of rubbers loaded with carbon black was also described at this session as was a comparatively fast and easy test for measuring the relative state of cure.

The seventh—and final—session, originally intended as a "catch-all," actually included the presentation of four excellent papers, two on textile fibers and two on tire technology. The textile papers covered, respectively, the results of an investigation designed to improve the adhesion of rubber to continuous filament fibers by a method of abrading the surface of the fibrous materials; and the heat setting of "Terylene" for purposes of stabilization together with an investigation of bonding techniques. The two direct tire papers were concerned with wave phenomena in tires at high speed, which resulted in considerable discussion, and the influence of tread wear on fuel consumption which also stimulated lengthy discussion.

Closing of the Conference

The technical sessions closed on Friday afternoon, June 25, and some interesting closing remarks were made by several people closely associated with the conference. Dr. Naunton, who skillfully guided every session, in his closing remarks, pointed out the difficulties which faced the Conference Committee, the least of which was the necessity of rejecting almost half of the total number of papers submitted for presentation, from 90 to the 50 given. He expressed his general thanks to the delegates and urged that more time be given at future conferences to practical technology and less to pure science.

S. A. Brazier (Dunlop Rubber), appearing in behalf of Lord Baillieu, thanked Dr. Naunton and all of the sessional chairmen in the name of the Institution of the Rubber Industry for all of the excellent work they had done both before and during the conference. J. M. Buist (I.C.I.) then rose to remark that the conference was the most successful held to date and to express the special thanks of the Institution to F. M. Panzetta (Dunlop Rubber) for his work as chairman of the Executive Committee of the conference. Mr. Buist stated that whereas Mr. Panzetta was only the "stage manager" where the 1948 Conference was concerned he had been promoted to "producer" of the current one.

Mr. Panzetta, in turn, acknowledged the assistance he had received from various members of his own committee and from the other functioning committees, particularly to L. C. Bateman and G. A. Shires who had read all of the papers submitted to the conference, to B. J. A. Martin (Dunlop Rubber) who had organized the instrument exhibition, and to P. D. Patterson (Dunlop Rubber) who was in charge of publicity. He stressed the fact that the I.R.I. was always interested in methods for improving the conferences and urged his listeners to send any suggestions they might have for such improvement to the secretary.

Dr. Bateman then took over and announced that Dr. T. H. Messenger, of the Research Association of British Rubber Manufacturers, had consented to act as editor-in-chief of the "Proceedings," and urged all of the authors and those wishing to supply written discussions on any of the papers to cooperate with Dr. Messenger so the "Proceedings" could be issued as quickly as possible. All registered delegates will receive copies of the "Proceedings," which will contain all of the conference papers and all written and oral discussion, on publication.

The high standard of the conference was then acknowledged by Dr. R. Houwink (Rubber-Stichting) on behalf of the delegates, with special thanks to the entire staff of the Institution of the Rubber Industry for attending to the innumerable details involved in so extensive a conference. Mr. Brazier brought the conference to a close by extending the special thanks of the Institution to all of the delegates, particularly those from overseas, and indicated that the next conference will be held either in 1958 or 1959, the exact date to be determined at some future time.

Exhibition of Instruments

Of special interest in connection with the 1954 Conference was an exhibition of instruments. This exhibition, which attracted considerable attention, was organized by Mr. Martin and was intended to show some of the developments which have taken place, primarily in Great Britain, since the last conference was held in 1948. The instruments were grouped into eight specific categories, as follows: (a) Accessories; (b) Intermittent and Slow Cycle; (c) Deterioration; (d) Processing; (e) Temperature Effects; (f) Static; (g) Dynamic, Continuous Cycle; (h) Chemical, Latex, Raw Materials.

Here again, as in the case of the technical papers, it is exceptionally difficult to indicate which of the instruments shown are of greater importance to the rubber industry at large, since they covered so wide a range of testing and control. The following paragraphs, however, briefly discuss some of those which received major attention at the conference.

Accessories: Included in this group was a dumb-bell autographic recording unit for tensile testing machines, developed by the I.C.I. Rubber Service Department and available from Goodbrand & Co., Ltd. This unit permits the autographic recording on paper of stress-strain properties of a standard rubber dumb-bell shaped test piece in tension. A new probe and a cutter for crack-growth testing which permit starting single cracks in test pieces so that the rate of growth of cracks can be measured, both developed by the Dunlop Research Center, were also of interest. Other accessories shown included a razor blade cutter for tensile rings, springs for the calibration of tensile machines, self-closing grips for rubber specimens, and a jigged piercer and a probe locator for crack-growth test pieces.

Intermittent: Several new instruments were shown in this group, including (a) the Wallace micro hardness tester which works on the null reading principle and measures the depth of indentation mechanically; (b) the "I.P" micro hardness tester, developed by Pirelli of Italy, which allows hardness measurements of rubber specimens of about 1 mm. thickness in the same units as a standard instrument; (c) a peeling tensiometer, developed by the British Boot, Shoe and Allied Trades Research Association, which measures the peeling strength of adhesive joints in which one or both sub-

Some of the Delegates at the Conference

The Third Rubber Technology Conference attracted many of the world's major figures in the rubber industry. Seen above are only a few of the delegates to the conference: 1—J. H. Carrington; 2—G. Le Person; 3—I. Drogin; 4—M. E. Lerner (RUBBER AGE); 5—J. W. Crosby; 6—Dr. J. T. Blake; 7—A. W. Birley; 8—P. W. Allen; 9—F. R. Kipping; 10—E. D. Farlie; 11—W. McG. Morgan; 12—W. P. Fletcher; 13—Dr. R. G. Newton; 14—Dr. S. M. Cadwell; 15—A. V. Howson; 16—F. A. Jones; 17—Dr. J. T. Watts; 18—W. A. Gurney; 19—O. K. E. Bussemaker; 20—G. W. Usherwood; 21—Dr. R. J. Tudor; 22—Dr. T. Gabris; 23—R. H. Schlicht; 24—G. Nordmann; 25—A. E. Herbert; 26—M. Arnett; 27—J. Westhead; 28—E. H. Hammond; 29—Dr. A. Catherall; 30—Dr. W. H. Bodger.

strates are flexible, and (d) the Hounsfield rubber tensile testing machine, produced by Tensometer, Ltd., which handles both dumb-bell and ring specimens. Other units in this category included a tripsometer, friction meters, a dead-load hardness tester for rolls, hardness meters, thickness measuring devices, a strain tester, and a modulus balance.

Deterioration: Three units were exhibited in this group, including an ozone test cabinet for testing the resistance of stretched rubber to cracking and a stress relaxation apparatus for studying tension stress relaxation in vulcanized rubber at elevated temperatures, both developed by the Research Association of British Rubber Manufacturers. The third unit was a multi-cell aging oven developed by Monsanto Chemicals, Ltd., which can be used for either rubber or plastics.

Processing: Five units were covered by this category, including a portable tackmeter (Dunlop) which enables tackiness to be measured easily and quickly over large areas without damage, a rapid plastimeter (Wallace) which enables a test piece to be prepared and accurate plasticity readings to be made in less than a minute, and the Atkinson Nancarrow extrusion plastometer (Tensometer, Ltd.) which is a simple apparatus for measuring the plastic properties of materials over a wide temperature range. The two other units were a laboratory extrusion test die and a miniature coaxial cylinder plastometer, both developed at the Dunlop Research Center.

Temperature Effects: Three units were found here, including one for determining the second-order transition point, the Scott Model E brittleness tester, and a torsional pendulum tester developed by the British Rubber Producers' Research Association. The first unit mentioned, developed at the Dunlop Research Center, enables linear expansion of small rubber test pieces to be studied over the range from +20° to −65°C. It uses optical lever methods of measuring the linear expansion.

Static: Four units were displayed in this group, including a simple permeability apparatus, a new densimeter, a high pressure conductivity unit, and the Baldwin-Dunlop Statigun, a portable instrument for measuring the voltage and charge of electrostatic charges on various surfaces, including rubber. Developed by Dunlop, it is available from the Baldwin Instrument Co., Ltd.

Dynamic, Continuous Cycle: Of major interest in this group was a dynamic compression test for the adhesion of rubber to cord fabric, developed by Henley's Tyre & Rubber Co., Ltd., and a new dynamic compression testing machine designed by the Mechanical Engineering Department of the University of Nottingham. In the Henley's unit, a single cord surrounded by a thick cylindrical sheath of rubber is subjected to cyclic bending and compression across one diameter while the cord sustains a steady tension and the ambient temperature is maintained at a suitable level. Other units on display included flexing machines, the Dunlop tire cord fatigue tester, a constant torque DuPont abrasion machine, and a compression fatigue unit.

Chemical, Latex, Raw Materials: Units for determining volatile fatty acids in natural latex, the mechanical stability of concentrated latex, the resistivity-compression characteristics of carbon black, and total sulfur in rubber were included in this group. Of particular interest was an apparatus for the micro-determination of free sulfur in rubber, an adaptation of the macro procedure already covered in a British standard.

Since it was not possible for the exhibit to include actual testing units made in all parts of the world, some of the latest developments occurring overseas were shown in the form of photographs, including the strain tester, Accr-O-Meter, and multi-cell aging oven made by Scott Testers, Inc., in the United States, and the abrasion and hardness testing units made by Zwick & Co. in Germany. Samples of products made from modified natural rubber were also displayed at the exhibit, including polymer-modified natural rubber, a tire retreaded with an oil-extended natural rubber compound, and samples of rubber reinforced by resins prepared in Hevea latex. An extensive display of books was also part of the exhibit as were the originals of some of the cartoons which have been appearing in the *India-Rubber Journal* as well as some prepared by Dr. Weinbrenner of Leverkusen, Germany.

Social Activities at Conference

The social activities arranged within the scope of the Third Rubber Technology Conference, as well as some of the entertaining accomplished during conference week itself, played an important part in the success of the meeting. The two major events, judged by conference procedures, were a Government Reception held at Lancaster House for all delegates given on the evening of Tuesday, June 22, at which the guests were received by Lord Woolton, Chancellor of the Duchy of Lancaster and Minister of Materials, and the official I.R.I. reception and banquet held at the Trocadero Restaurant in Piccadilly Circus the night of Friday, June 25.

Interspersed between these two latter events were receptions given by Cyanamid Products, Ltd., at the Savoy Hotel, at which R. E. Lapcan, managing director of the company, and H. C. Gant, a director, received, and by Dunlop Rubber Co., Ltd., at Claridge's Hotel, at which Lord Baillieu received. In addition to numerous other functions which occupied the delegates at various times, were dinners given by Anchor Chemical Co., Ltd., at the Savoy Hotel and by Chance and Hunt, Ltd., at the Hotel Rubens, the latter in the form of a going-away party to Mr. & Mrs. A. G. Treadgold. Mr. Treadgold, sales manager of the United Carbon Co., was returning to the United States after an extensive visit to England, the Continent and the Scandinavian countries.

The banquet held at the Trocadero on the night of June 25th was, of course, the finishing touch to the conference. After an appetizing dinner, the toast to the Queen was proposed by Lord Baillieu, following which Dr. A. A. Morton (M.I.T.) proposed a toast to the Institution of the Rubber Industry. In making the toast, Dr. Morton referred to the friendly rivalries which were evident at the conference, emphasized the importance of meeting people face to face, and expressed the hope for additional international forums so that international good-will could be maintained. Dr. Morton facetiously referred to himself as one of those "starry-eyed pure scientists."

In responding to this toast on behalf of the Institution, Lord Baillieu stated that he considered the 1954 Conference a definite success, since the papers were of high quality and the delegates came from so many nations. He paid special thanks to Lord Salisbury for his interest in the conference and asked Sir Ben Lockspeiser, who was present, to convey such thanks. Lord Baillieu deprecated the false antipathy which exists in some quarters between the natural and synthetic rubber interests, and stated that both were vital to society. He paid special tribute to the work of Messrs. Naunton, Martin and Patterson, and expressed his personal thanks to the entire staff of the I.R.I. and all others concerned with the details of the conference. He also presented tokens of

appreciation from the I.R.I to the ladies in charge of the various excursions made by the wives, daughters and friends of the delegates.

Dr. Naunton, as chairman of the conference, then proposed a toast to "The Guests," during which he made mention of some of the prominent rubber technologists who had attended the conference, naming one or more from some 10 different nations and related anecdotes from time to time concerning some of these men. Responses were then made in turn by the following: D. H. Kemp (Australia), Dr. P. Thirion (France), Dr. P. Stöckline (Germany), Professor Dr. A. Van Rossem (Netherlands), Bo Sarno (Scandinavia), and Bancroft W. Henderson (United States). This concluded the banquet, but dancing was enjoyed until midnight.

Commentary

Reference has already been made above to the tremendous amount of work performed by various people concerned with the details of the Third Rubber Technology Conference, particularly Dr. Naunton as chairman of the conference and Mr. Panzetta as chairman of the Executive Committee. It would be unfair, however, not to mention the work performed by other members of various committees and especially the behind-the-scenes work of Mr. G. E. Holmes-Siedle, I.R.I. secretary who also served as conference secretary, or of his assistant, Mr. Cravens. No effort was too great for either of these two Institution stalwarts where the delegates, particularly the overseas delegates, were concerned. Special credit also must be given to the staff of the Institution, all of whom performed so well in the accomplishment of their respective duties.

Assisting Mr. Panzetta on the Executive Committee for the conference were the following: F. D. Ascoli, L. C. Bateman, C. F. Flint, B. J. A. Martin, George Martin, L. Mullins, H. L. Nash, W. J. S. Naunton, J. R. Scott, G. A. Shires, and S. D. Sutton. Mr. Nash also functioned as chairman of the Entertainment Committee, and was assisted by C. H. J. Avons, H. C. Baker, G. H. Harris, N. C. H. Humphreys, and F. C. Moore. There are undoubtedly others whose assistance in making the conference the success it was should be acknowledged, and the thanks of the delegates include such personnel as well.

Abstracts of Rubber Technology Conference Papers

Properties of Natural Rubber Latex

Micro-Gel in Latex and Sheet Rubber. ***R. Freeman (Rubber Research Institute of Malaya, Kuala Lumpur, Malaya).***

The rubber hydrocarbon in fresh latex can be dispersed in benzene to form a solution that passes easily through a porosity 1 sintered filter. When this solution is treated with a finely divided absorbent powder, part of the rubber is removed from solution. The powders that have been tried and found effective are $CaSO_4$ (anhydrous), $Ca(OH)_2$, CaO, Kaolin, MgO, Kieselguhr, charcoal, lamp black, furnace black and channel black. These materials have nothing in common except a small particle size. The amount of rubber removed varies with the adsorbent used. The actual viscosity of the solutions is not affected by the removal of 10-20% of the rubber present. Similar results can be obtained by centrifuging the solution at 144,000 g. These results can be explained by assuming that part of the rubber in normal latex is micro-gel, i.e., cross-linked rubber particles of small size.

The micro-gel latices examined by Bloomfield are shown to be a special type of latex in which most of the rubber is present as micro-gel. Some micro-gel is present in every sample of latex examined. The amount of micro-gel depends on the clone, and varies between 5% and 30% of the total rubber. An average value for bulked latex is 15%. The micro-gel content of a latex can be increased by treating the latex with a redox system as used to initiate polymerization. The increase in micro-gel is accompanied by an increase in the Mooney viscosity of the dried rubber.

Micro-gel is not affected by coagulation and smoking of the sheet. In freshly prepared smoked sheet the micro-gel content is similar to that of the original latex. On storage the micro-gel is no longer detectable, but a macro-gel component appears. The particle size of micro-gel has been estimated as 0.1 mμ. This is smaller than the size of the latex particles from which the micro-gel was derived.

Production of Improved Rubbers by the Enzymatic Deproteinization of Skim Latex. ***J. E. Morris (Rubber Research Institute of Malaya, Kuala Lumpur, Malaya).***

The proteins in skim latex can be decomposed by proteolytic enzymes. Using animal pancreatic enzymes the protein content of the skim rubber product may be reduced to that of normal smoked sheet. The optimum deproteinization conditions for fresh skim latex have been found to be pH_8 and a temperature of 38-45°C. Calcium ions in 0.02 M concentration give a marked activation of the deproteinizing enzyme. The extent of protein removal cannot be predicted from the skim latex dry rubber, total solids or protein contents. The copper content of skim rubber is usually high and that of enzyme treated skim rubber is dependent on the digestion pH and temperature. Optimum copper removal occurs at pH_8 but increasing temperature gives an increase in the copper content of the rubber product. Methods of copper reduction are given. The cost of the deproteinization process and of copper removal is briefly discussed and the relative activities of 25 commercial enzyme preparations have been determined. Methods of carrying out the digestion on the factory scale are appended.

Stability of Ammoniated Latex and Soap-Stabilized Emulsions in the Presence of Complex Zinc Salts. ***T. S. McRoberts (British Rubber Producers' Research Association, Shawbury, Shropshire, England).***

The solubility of zinc oxide in solutions of ammonia and different ammonium salts has been determined. The interaction between ammonium laurate and zinc amine (or ethylene diamine) salts has been studied in aqueous solution, in latex and in oil emulsions. The results indicate that destabilization of ammoniated latex or soap-stabilized emulsions by dissolved zinc oxide is due to the presence of zinc diamine ions, which form insoluble dilaurates. It is suggested that the increased rate of destabilization at elevated temperatures is most probably due to a decrease in hydration of the zinc diamine dilaurate formed at the surface of the rubber or oil particles.

Variability of Hevea Latex. ***W. L. Resing (Indonesian Rubber Research Institute, Bogor, Indonesia).***

A study is made of the differences in composition between a number of clonal latices. Of great importance in connection with the stability of latex are to be considered the differences found in PO_4/Mg ratios. The properties of the concentrate of a number of clonal latices from different origin were studied in connection with the PO_4/Mg ratio of the field latices. The disastrous effect of magnesium ions on the processing quality of concentrated latex, especially in case of foam rubber production, was fully confirmed. A suggestion is made about the proper treatment of such instable latices, as at least in Western Java such latices are frequently found.

Zinc Oxide Testing of Latex. ***E. W. Madge, H. M. Collier, and J. L. M. Newnham (Dunlop Rubber Co., Ltd., Birmingham, England).***

Viscosity changes in concentrated latex under different experimental conditions have been investigated, the object being to determine the mechanism of zinc oxide thickening and to find

reasons for inconsistencies in correlating results of the zinc oxide thickening or ZOT test with other latex tests. It has been found that small variations in the amount of natural soap are of great importance in the thickening of latex containing zinc oxide, especially at the low ammonia content used for the ZOT test.

The effect of added soap on the ZOT was found to vary from latex to latex and to be different for different soaps. Less than about 0.3% of various soaps, added to latex prior to the zinc oxide, reduced the degree and rate of thickening. With more than this amount of soap the thickening depended on the soap used.

A similar investigation was carried out in which the mechanical stability was measured of latices containing varying amounts of added soap and a standard amount of zinc oxide. Again the behavior was found to vary anomalously with the amount and type of soap. The results show that new tests for the zinc sensitivity of latex must take into account a number of hitherto unsuspected factors particularly when such tests are required to have a bearing on processing behavior.

Structure of Hevea Latex and its Viscosity. ***G. Verhaar (Firestone Plantations Co., Liberia).***

Fresh Hevea latex is characterized by the presence of viscoids of greatly varying size (5-200 micron). When the viscosity of such a latex is determined with a viscometer of the rotary type the values found cover a wide range, with no clear relation to the initial DRC of the latex. Also with the aid of a rotary viscometer the structural viscosity of fresh or any other type of latex can be clearly demonstrated. When fresh Hevea latex is treated with ammonia in increasing amounts there is a sharp and regular drop in viscosity up to 0.05% NH_3. This runs parallel with a gradual and finally complete disintegration of the viscoids. Treatment with sodium sulfite in increasing concentrations up to 0.30% yields a more slowly decreasing viscosity with end values approximately twice as high as with ammonia. Microscopic investigation shows a slow and only partial breakdown of the viscoids in the same area. Formaldehyde gave irregular results, but in general, did not decrease or increase the initial viscosity considerably, neither could any influence be established on the size and shape of the viscoids. The viscosity of fresh Hevea latex is profoundly influenced by addition of distilled water giving a considerable increase up to 20% and a sharp drop afterwards. Latex diluted with 20% of water was microscopically found to be in a stage of pre-coagulation, with the immobilized rubber particles embedded in the viscoid complexes. It is concluded that the viscoids play a dominant role in viscosity phenomena in Hevea latex.

Contribution to the Study of Mineral Elements in Field Latex. ***E. R. Beaufils (Institut Français du Caoutchouc, 42 Rue Scheffer, Paris, France).***

The mineral elements of latex have been determined more than once and quoted in particular in the works of Kaye, Beadle and Stevens in 1913, de Vries in 1920, Bruce in 1922, Rae in 1928, Wiltshire in 1930, Schweizer in 1935, and Flint and Ramage in 1935. A summary of these different studies was given by C. E. Flint in the "Chemistry and Technology of Rubber Latex" in 1938. However, it is impossible to deduce, from these various reports, the nature of variations in fresh latex arising from the different mineral elements present.

The object of the present work is to present basic data concerning the variability of mineral elements in latex. It cannot be claimed that all variability factors have been examined. It is hoped that the observed variations cover the essential causes. Although the soil factor could not be systematically examined, it is possible to infer the influence of this factor on the latex content from different cross-checkings.

Here are given some data on variability for all latex mineral elements except iron, manganese and rubidium, for which the following remarks are deemed sufficient. Iron was analyzed several times in recent years on different samples of field latex. Frequently, none was found. Very small quantities, averaging 1/1000 gm. per 100 gm. latex were sometimes observed, provided highly concentrated ash solutions were used.

No trace of manganese was found in latex from "grey soils". Traces were found in some latices from "red soils", although the content never exceeded 0.1 mgm. % dry extract. The presence of rubidium was noted by Flint and Ramage who pointed out a relatively high proportion of this metal in latex. Rubidium titration is somewhat difficult, and efforts to reproduce this analysis as a routine have been unsuccessful. On the basis of the rubidium spectrum and taking potassium interference into account, a content of about 0.7 mgm. % gm. of latex was found. This was slightly below the value indicated by Flint and Ramage, but it is interesting to note that it was higher than any observed contents of copper, which may be considered as the main oligo-element in the latex. However, rubidium is interesting from the biological point of view only.

Considerations About Rubber Peptized at the Plantation. ***G. Giger and J. Lemee (Institut Français du Caoutchouc, Paris, France) and M. Liponski (Institut des Recherches sur le Caoutchouc en Indochine, Saigon, Indo-China).***

The production of plantation-peptized rubber on an industrial scale has been going on for a number of years. In order to estimate the benefits conferred upon the user by the employment of this type of rubber, it has been compared with rubber plasticized on mixers of different types and sizes, such as laboratory and industrial types of open mill and internal mixers. The comparison included smoked sheets, plasticized during milling, with and without simultaneous addition of peptizer, and finally, soft rubber peptized at the plantation.

The results obtained confirm and define more clearly the remarks made by preceding authors, i.e., that the utilization of peptized rubber, used in preference to smoked sheets, insures a substantial reduction of the peak load appearing at the beginning of the mixing, as well as a reduction in plasticization time and over-all power consumption during the process.

The problem was to determine whether the additional expense incurred by the production of peptized rubber was lower than the savings made through its use. In most cases the answer seems to be positive, the difference becoming increasingly marked as the user's plasticization equipment is less powerful. Moreover, the greater the breakdown required, the greater is the advantage of using plantation peptized rubber.

This is the reason which has led us to develop the preparation of a type of rubber characterized by its low viscosity. The methods of preparation, as well as the properties of the product, are discussed. Since the Mooney viscosity of the rubber obtained may be lower than 50, it will be necessary to provide a special type of packing; this will naturally increase the costs, but the absolutely dirt-free rubber obtained amply compensates for any such expense.

Production and Evaluation of Synthetic Rubber

Cation and Anion Influence in the Alfin Reagent for the Polymerization of Butadiene. ***Avery A. Morton, Irina Nelidow and Emanuel Schoenberg (Massachusetts Institute of Technology, Cambridge, Mass.).***

A mixture of allylsodium, sodium isopropoxide and sodium chloride causes a very rapid polymerization of butadiene to a soluble polymer of unusually high molecular weight which has largely a 1,4-structure. The present work is a study of the influence of the sodium cation and of various halide salts, and of the isopropoxide ion as contrasted with the *n*-propoxide, upon the proportion of 1,4-polymerization. A proper combination of ions will favor greatly the end to end polymerization and any given reagent may cause either 1,4- or 1,2-polymerization to take place, depending on the composition of the reagent. An explanation based on adsorption and orientation of diene molecules on the surface of the insoluble aggregate of ions is suggested. (This work was performed as a part of the research project sponsored by the Reconstruction Finance Corporation, Office of Synthetic Rubber, in connection with the Government Synthetic Rubber Program.)

How Synthetic Rubbers Affect You. ***Ian D. Patterson (Goodyear Tire and Rubber Co., Akron, Ohio).***

Synthetic rubbers have found their place in the economy of war and peace. Their continued production is indicated as necessary for progress in the world's welfare. Tough, high molecular weight polymers, made usable by masterbatching with

oil, have proved their superior quality and economy by three years' application on a large scale. The Olsen flow test has been added as a means for choosing better polymers capable of holding larger amounts of oil and for adhesives.

High solids butadiene/styrene copolymer and butadiene polymer latices have improved in quality so that they can be used in larger amounts for foamed rubber products. An evaluation of their status is indicated. Medium and low solids butadiene/styrene latices have been successful as base ingredients for adhesives and paints. The Olsen flow test has been useful in coordinating properties of the polymer with needs for end use in adhesives. Types of agitation, reactors, concentrators, heat exchangers, batch and continuous polymerization have been important contributions in the chemical engineering phase of the program.

Pyridinium High Polymers—A New Class of Oil-Resistant Synthetic Rubbers. ***W. B. Reynolds, J. E. Pritchard, M. H. Opheim and Gerard Kraus (Research Division, Phillips Petroleum Co., Bartlesville, Okla.).***

Copolymers of butadiene and 2-methyl-5-vinylpyridine are readily "vulcanized" by heating in the presence of organic halides. The number of effective cross-links can be readily calculated from moduli of swollen stocks using the network-statistical theory of rubber elasticity. Cross-linking depends upon the amount and activity of the quaternizing agent. However, even at low levels of halide it appears that several quaternary groupings are necessary for each effective cross-link. Zinc oxide greatly increases the swollen moduli of the copolymer-halide systems. However, sulfur and accelerator alone have little effect on the same system and these agents do not further increase the swollen moduli of the ternary system, copolymer-halide-ZnO.

Rubbery Copolymers from Unsaturated Ketones. ***W. Cooper, T. B. Bird and E. Catterall (Dunlop Research Center, Birmingham, England).***

The preparation and properties of copolymers from unsaturated ketones with acrylate esters and with butadiene are described. Details of the polymerization reactions and the structure of the copolymers are given. The preparation and properties of compounded vulcanized polymers are described and, in the case of the ketone-acrylate copolymers, the mechanism of sulfur vulcanization is discussed.

Preparation and Some Properties of Condensation Block Copolymers. ***D. H. Coffey and T. J. Meyrick (Imperial Chemical Industries, Ltd., Welwyn Garden City, England).***

By using diisocyanates to link together two different polyesters having terminal hydroxyl or carboxyl groups, copolymers have been obtained in which the two repeating units occur in blocks and not in the random arrangement obtained by normal methods of preparing copolymers.

Melting points have been measured by a penetrometer method and the effect of copolymer composition on melting point determined. In a series of crystalline copolymers made by linking various amounts of polyethylene sebacate and polyethylene adipate with hexamethylene diisocyanate, a step-shaped melting point *vs.* composition curve is obtained; copolymers containing up to about 40% of polyethylene adipate have the same melting point as that of polyethylene sebacate; further increase in the polyethylene adipate content results in a rapid drop in melting point until the melting point of polyethylene adipate is reached; thereafter increasing amounts of polyethylene adipate do not alter the melting point. Random copolymers of ethylene adipate and ethylene sebacate give a V-shaped melting point *vs.* composition curve. The step-shaped curve of block copolymers is almost identical with the melting point *vs.* composition curve of melt blends of the two polymers.

Stress-strain characteristics and impact strengths of the block copolymers have been measured. In the polyethylene adipate/polyethylene sebacate/hexamethylene diisocyanate series no great differences are found between random and block copolymers. If, however, the crystalline polyethylene adipate is replaced by the non-crystalline polypropylene adipate, then block copolymers containing 15-30% of polypropylene adipate have outstanding impact strength. Similar high impact strength is obtained by using a compatible rubbery polymer as an external plasticizer with hexamethylene diisocyanate modified polyethylene sebacate.

This method of block copolymerization has an advantage over random copolymerization in that a crystalline copolymer can be modified without reduction of its melting point, and by suitable selection of a second component it affords a means of "building in" a plasticizer.

Graft Polymers Derived From Natural Rubber. ***G. F. Bloomfield, F. M. Merrett, F. J. Popham and P. McL. Swift (British Rubber Producers' Research Association, Welwyn Garden City, England).***

When vinyl monomers are polymerized in the presence of rubber under suitable conditions some of the polymeric chains become attached to rubber molecules and a "graft polymer" is obtained. The products contain a varying amount of free polymer formed concomitantly with the graft polymer, but do not contain any free rubber provided that a suitable proportion of vinyl monomer is used. In this way the properties of natural rubber can be widely modified according to the nature and amount of the grafted polymer, and, in particular, when hard polymers are so incorporated their already known reinforcing effect is supplemented by the advantages obtained by having a considerable proportion of polymeric filler chemically linked to the rubber. Some of the modified materials, more especially those made from polar monomers, have rather unusual solubility characteristics arising from the different behavior towards solvents of the polymer and rubber components of the molecules.

Experimental methods specially developed for the characterization of the products firmly establish the graft-polymer structure. Study of the influence of the type of polymerization catalyst has indicated that the polymer-modified rubbers so far studied appear to be produced by direct growth of polymer chains on to rubber molecules rather than by a transfer reaction involving the rubber. Graft polymers of styrene and methylmethacrylate with rubber can be readily compounded and cured to give light-colored articles of good tensile strength, and attention is drawn to the outstanding flex-cracking and fatigue resistance of rubber-methylmethacrylate graft polymers. The properties of vulcanizates based on various other polymers are briefly reviewed in the paper. Rubber modified with ethyl acrylate is difficult to vulcanize, and is more resistant to oxidation than raw rubber. Progress in the wider field of modification of rubber by combinations of polymerizing monomers is reviewed.

Oil Resistance of Synthetic Rubbers Over Very Long Periods of Time. ***Bo Särnö (AB Liljeholmens Kabelfabrik, Stockholm 9, Sweden).***

The investigation was to study the long-term oil resistance of synthetic rubber gaskets used in transformers and similar apparatus. For such equipment a long and reliable service life is essential as a failure will cause an expensive break in the electricity supply. The cost of replacement and oil losses may be considerable for big transformers. In view of the nature of the investigation it was natural to concentrate the study on practical compounding and to leave out purely scientific problems. Compounding principles recommended by the synthetic rubber manufacturers were mainly followed. Vulcanized slabs were best immersed in hot transformer oil until they had lost their rubber properties.

When a big transformer is fully loaded the top has a temperature of up to 85°C. In most cases the gaskets have a somewhat lower temperature, generally not exceeding 70°C. Therefore the latter was chosen as the testing temperature; some supplementary tests were, however, made at 20° and 100°C., and for polyacrylic rubbers even at 150°C. The duration of the immersion period has been dependent upon the changes in the rubber properties during the test and in some cases extended to 14 years.

The polymers studied were the neoprenes, the Swedish chloroprene rubber, Svedoprene, German and American perbunan, and the Hycars. The influence of compounding ingredients was investigated to a certain extent and some attention was given to the effect of the vulcanized rubber on the dielectric properties of the oil.

Structure and Solution Properties of High Molecular Weight Butadiene-Styrene Copolymers. ***R. B. MacFarlane and L. A. McLeod (Polymer Corp., Ltd., Research and Development Division, Sarnia, Ontario, Canada).***

Production of high molecular weight copolymers of butadiene and styrene for use in oil-extended rubbers has aroused interest in the solution properties of copolymers above the molecular weight range commonly encountered in commercial practice. It has been observed that solubility of such polymers in toluene is a time-dependent phenomenon and the apparent solubility can increase continuously, in the absence of agitation, for as long as 800 hours. Although a standard Harris cage solubility test may show the presence of 50% gel, other properties do not confirm the presence of any appreciable quantities of insoluble material. Mild agitation rapidly promotes almost complete solubility. Dilute solution viscosity measurements are very misleading unless the influence of solution time is recognized and apparent intrinsic viscosities rise progressively with time of contact of the sample with solvent.

This time-dependence of solution has been found to occur at conversions higher than 50% and is also a function of the amount of modifier used in the polymerization recipe. It has not been possible to shorten the solution time for viscosity measurements by mild heating or gentle agitation. Mixed solvents cause a change in the amount of increase of the apparent intrinsic viscosity but do not shorten the time to equilibrium.

Measurement of the slope constant in the Huggins viscosity equation indicate that these solubility and viscosity effects coincide with the appearance of a marked degree of branching in the polymer molecules. The effect is, therefore, interpreted as being caused by the relatively slow disentanglement of molecules of complex structure.

Recent Studies on the Structure of Synthetic Rubber. ***R. F. Dunbrook, B. L. Johnson, J. L. Binder, J. M. Willis and E. L. Carr (Chemical and Physical Reseach Laboratories, Firestone Tire and Rubber Co., Akron, Ohio).***

Synthetic rubber research workers have sought diligently to reproduce the structure of natural rubber and thereby evaluate the characteristics believed to be responsible for its good treadwear, high "gum" strength and low hysteresis. Tread wear superior to that of natural rubber has been achieved in low temperature polymer (LTP) despite the fact that its structure is not at all like that of natural rubber. It is postulated that the improvement in tread wear resistance of LTP over that of hot GR-S is a result of the smaller amount of low molecular weight material found in LTP. It has been found possible to obtain the LTP type molecular weight distribution in polymerization at 122°F. by use of diazo initiators (Nitrazole CF and AIBN) and also by other means. These polymers have wear resistance equal to LTP.

The microstructure which is considered necessary to duplicate the performance of natural rubber in other respects includes high linearity (1,4-addition) for high gum tensile strength and the *cis* configuration for retention of physical properties at high temperatures together with suitable physical properties at room temperature and below. A large amount of work carried out in the field of emulsion polymerization has shown that changes in the recipe have little effect on the microstructure of GR-S type synthetic rubber. It now appears that polymer structure can be influenced much more readily and to a greater degree by alkali metal initiation. These structural changes in polymers are produced by variations in metal initiator, temperature of polymerization and in the use of promoters with the initiator.

Chemistry of Rubber

Studies in Latex Particle Surface Reactions: Kinetics of Hydrochlorination of Unvulcanized and Vulcanized Latices. ***Manfred Gordon and James S. Taylor (Royal Technical College, Glasgow, Scotland).***

In the van Veersen hydrochlorination of latex, two stages, associated with different reaction loci and mechanisms, are distinguishable: a "surface reaction" in an outer shell and a "bulk reaction" inside the particle. The rate control of the two mechanisms is briefly discussed. The surface reaction stands isolated at low pressures of HCl, and is measurable down to about 0.08 atm. of HCl gas. It affects only about 2% of the rubber in Hevea latex, but up to over 20% of synthetic or selectively creamed Hevea latex with sufficiently fine particles. The saturation of double bonds at the surface locus proceeds in an inward direction from the particle surface, and is limited to about the outer four layers of polymer chains. This restriction is due to the instability of the diffusing reagent in the rubber medium, which also accounts for the enormous nominal reaction order of the surface reaction. This order was found to be about 26 in one run, while the bulk reaction follows zero order kinetics. The kinetics of the isolated surface reaction is shown to be a useful tool in studying the unsaturation of the surface layers in prevulcanized latex. By its means it is proved that a surface reaction can also affect latex vulcanization. This is technically important, because the film strength of latex decreases critically with increasing vulcanization of the particle surface. Brief generalized conclusions concerning the significance of kinetic studies on latex reactions, and particularly of the rate control, are appended.

Oxygen-Absorption Effects in Cured and Uncured Natural Rubber. ***R. L. Stafford (Imperial Chemical Industries, Ltd., Welwyn Garden City, England).***

The general three-stage type of thermal oxidation curve is discussed. It is shown that the effects on oxygen absorption of initial degree of cure of the compound, the temperature of oxidation and the presence of compounding ingredients such as antioxidants, can very largely be described in terms of a relative shift of the three stages of oxidation, the basic form of the oxidation curve being preserved.

Experiments are discussed in which oxygen absorption is measured during the onset of sulfur combination; from these it appears that high rates of oxygen absorption are intimately connected with high rates of sulfur combination and that the initial high-rate stage of the typical oxidation curve reflects the continued curing of the compound. The above considerations affect the relative assessment of antioxidants, both by oxygen absorption and conventional accelerated aging tests.

With raw natural rubber it is shown that the past history of the test piece very largely determines the type of thermal and photo-oxidation curve which is subsequently observed. Photo-oxidation experiments are discussed in which the control films used were made from latex which had been tapped and stored in the dark, the rubber receiving its first exposure to illumination in the oxygen-absorption apparatus. The effect of milling on raw rubber activates both thermal and photo-oxidation, the activation being subject to a decay process which complicates the interpretation of oxygen-absorption data.

Infra-Red Spectroscopic Analysis of Elastomers. ***W. H. T. Davison and G. R. Bates (Dunlop Rubber Co., Ltd., Birmingham, England).***

Infra-red absorption spectroscopy is the most generally applicable technique available for the analysis of elastomers and other polymers encountered in the rubber industry. The emphasis of this paper is on the general identification and estimation of a wide range of elastomers, rather than the accurate quantitative analysis of particular copolymers and mixtures.

The theoretical basis of spectra, particularly of polymers, is described. The additivity of absorbances is the basis of quantitative analyses, for which the procedures are outlined. Although theoretically some interaction between repeating units is to be expected, most repeating units have the same spectra whether in homopolymers or copolymers.

Experimental techniques are described for preparing samples for spectroscopic examination from both uncured and cured materials. The latter, particularly when reinforced with carbon black, often give difficulty since they transmit insufficient energy for direct examination. As an alternative to solution or pyrolysis, a reflecting microscope may be used to increase the amount of energy available for measurement of the spectrum.

Spectra of a large number of homopolymers, copolymers and mixtures are reported from 650-3600 cm.$^{-1}$, mostly in simplified line form. Polymers covered include polydienes, polyvinyl and *iso*propenyl compounds (including polyketones and acrylates), polyesters, polyurethanes, modified polyethylenes and silicones.

A summary of absorptions characteristic of particular polymer structures is given in the form of a correlation chart. The limitations of the technique are discussed, and probable future developments are suggested, i.e., extension of the spectral range below 650 cm.$^{-1}$, improved techniques of sample preparation, and combinations of spectroscopy with chemical procedures such as pyrolysis.

Structural Characteristics of the Sulfur Linkage in Natural Rubber Vulcanizates. ***L. Bateman, R. W. Glazebrook, C. G. Moore and R. W. Saville (British Rubber Producers' Research Association, Welwyn Garden City, England).***

Polyisoprenes react with sulfur both intramolecularly and intermolecularly to yield cyclic sulfides and cross-linked sulfides respectively. The structures of these have been examined for the reaction of the di-isoprene, 2:6-dimethylocta-2:6-diene, with sulfur at 140°. The cyclic sulfides consist of the two saturated compounds (I) and (II) and the two unsaturated compounds (III) and (IV). The cross-linked sulfide consists of a complex mixture in which unsaturated open chain and saturated and unsaturated cyclic sulfide structures have been identified. The structures of these products suggest a polar reaction mechanism, and also that hydrogen sulfide participates in the reaction. The influence of organic bases, the sulfurizing agent, reaction temperature and zinc salts on the nature of the sulfur linkage is discussed.

Behavior of Highly-Filled Rubber Vulcanizates. ***K. C. Bryant and D. C. Bisset (Monsanto Chemicals, Ltd., Victoria St., London, S. W. 1, England).***

The examination of the stress-strain curves of vulcanizates containing up to 60% v/v of mineral filler of particle-size greater than 1 mμ has led to the discovery of a "plateau" at which the elongation increases several hundredfold at constant stress. This has been demonstrated for a number of fillers with several rubbers, natural and synthetic. The effect of filler content, particle-size, degree of cure, on the stress at which the plateau occurs, and its length have been investigated. An explanation is suggested and the significance of the observations for the experimental verification of equations relating modulus to filler content is pointed out.

The volume changes accompanying the elongation of these vulcanizates have also been investigated at varying filler contents, particle-sizes and degrees of cure, and shown to correlate with the stress-strain curves. The possible bearing of these results on the nature of the rubber-filler bonds, and hence on the reinforcing action of fillers is briefly discussed.

Some Chemical Reactions of Antioxidants Used in Vulcanized Rubber. ***P. Schneider (Farbenfabriken Bayer, A.-G., Leverkusen, Germany).***

The work by Farmer and other authors has shown that the oxidation of unsaturated polymers proceeds via primary-formed hydroperoxides. The addition of antioxidants, including chiefly compounds of the class of the phenols and secondary aromatic amines, makes it possible to delay to a great extent the chemical changes taking place on unsaturated compounds. The mechanism of the action of phenols on the oxidation has been explained by Bolland.

It is difficult to separate from the polymer the reaction products which are formed from the antioxidant by the dehydrogenating action of the polymeric hydroperoxide radical. In view of the fact, however, that the kinetics of oxidation in the presence of added peroxide corresponds to the autoxidation of the unsaturated compound, the reaction between phenols or secondary aromatic amines and organic or inorganic oxidation agents has been studied in detail by several workers.

Depending on type, position and number of the substituents, different reaction products are formed from phenols. Diphenylamine reacts with manganese dioxide to form a mixture of N,N'-diphenylbenzidine and the corresponding quinonediamil. N,N'-tri-β-naphthyl-1,2-naphthylenediamine is formed from β-dinaphthylamine with potassium permanganate, whereas under equal conditions N-phenyl-β-naphthylamine forms N,N'-diphenyl-N-2-naphthyl-1,2-naphthylenediamine.

Starting from the deduction that the chemical reaction products of the antioxidants accumulate on the surface of the vulcanized rubber due to decreasing solubility, pure gum stocks of cured natural rubber containing diphenylamine, N-phenyl-α- and β-naphthylamine have been exposed to atmospheric conditions for eight months. The dark-colored reaction products could be removed mechanically from the surface of the cured goods after wetting with methanol. After evaporation, the residue was taken up in ethylidene chloride and the resulting solution evaporated to dryness. Amorphous mixtures of brown-colored compounds were isolated from the vulcanizate containing diphenyl-amine and N-phenyl-β-naphthylamine, the reaction products of the N-phenyl-α-naphthylamine being obtained as a dark-colored tar. In addition to other compounds, the presence of the N,N'-diphenyl-N-2-naphthyl-1,2 naphthylenediamine was proved by paper partition chromatography of the resulting azodyestuff obtained from the mixture of the reaction products from N-phenyl-β-naphthylamine by coupling with diazotized 1-aminonaphthalene trisulfonic acid. The presence of this compound had also been shown by the UV-spectra. In the same manner, small quantities of the N,N'-diphenylbenzidine could be recognized from the corresponding azodyestuff formed from the reaction product of diphenylamine. Due to extensive oxidation, the presence of reaction products could not be proved in any appreciable quantity from the reaction mixture of the N-phenyl-α-naphthylamine.

Crosslinking and Radiation Effects in Some Natural and Synthetic Rubbers. ***A. Charlesby and Miss D. Groves (Atomic Energy Research Establishment, Harwell, England).***

When subjected to atomic energy radiation certain polymers crosslink, a process which is equivalent to vulcanization, but occurs without the admixture of extraneous chemical agents. Other polymers degrade by main chain fracture, a process which occurs at random throughout the molecule, and is different from thermal or ultra-violet degradation.

Of the various methods available for detecting crosslinking in irradiated polymers, two, based on solubility and swelling, have been used to study the effect of high energy radiation on a number of natural and synthetic rubbers. The materials investigated include natural rubber, polychloroprene, polyisobutylene, butadiene and thioplasts, as well as a number of copolymers. The results obtained show that the degree of crosslinking is proportional to radiation dose, and is reduced by the presence of styrene or acrylonitrile in copolymers. Possible applications of this physical technique of linking molecules are discussed briefly.

Physics of Rubber

Modifications of the Permeability of Natural Rubber Vulcanizates. ***P. Thirion (Institut Français du Caoutchouc, 42 Rue Scheffer, Paris, France).***

Vulcanizates with a low permeability may be obtained by incorporating into natural rubber mineral fillers or other elastomers. Thus the relative permeability of mixtures containing 20 vols. % of ordinary fillers is, compared to a pure-gum compound, generally between 83% and 59%; while the permeability of mixtures containing the same proportion of mica powder or other special fillers such as bentones may vary between 52% and 21%. Temperature and the nature of the gas will only have a very slight influence on these values. However, when we try to explain the permeability reduction from strictly geometrical considerations, we are faced by the fact that mixtures containing ordinary mineral fillers, such as chalk, have a greater permeability than is predicted theoretically.

The incorporation into natural rubber of other elastomers of low permeability does not reduce the permeability as effectively as the addition of lamellar fillers. Besides factors such as the relative concentrations and the permeability of the components, another factor intervenes, which characterizes the colloidal structure of the mixtures of elastomers.

Reinforcement and Tear Strength Anisotropy. ***H. J. J. Janssen (Rubber-Stichting, Delft, Holland).***

Anisotropy in respect to tearing of natural rubber-carbon black compounds after pre-stretching can be demonstrated with the Delft tear test method. Possible effects of this tear strength anisotropy on the problem of reinforcement—especially for the

type of abrasion leading to Schallamach's abrasion pattern—are discussed. It appears that, if it is permissible to extrapolate the results found under slow extension to the conditions encountered during service, the tear strength anisotropy of natural rubber—carbon black compounds would be beneficial to reinforcement against tearing but disadvantageous to reinforcement against abrasion.

Elasticity of Ideal and Real Rubberlike Materials. ***Hubert M. James (Dept. of Physics, Purdue University, West Lafayette, Ind.) and Eugene Guth (Polymer Physics Laboratory, University of Notre Dame, Notre Dame, Ind.).***

The assumptions and stress-strain relation of the statistical network theory of ideal rubberlike materials are briefly surveyed. It is pointed out that the stress-strain relation corrected for thermal expansion is similar to van der Waals' equation for a real gas. Recent accurate measurements at Notre Dame on dry gum stocks check the theoretical stress-strain relation for extensions from 1 to 15%.

A new model for real rubbers is described briefly. This model includes intermolecular forces of van der Waals' character which tend to establish definite orientations of next-neighbor links with respect to each other. This model shows orientational melting; its theoretical treatment is similar to the internal Weiss field treatment of ferromagnetism. The present paper deals only with the stress-strain relation that is valid at temperatures well above the melting range. This stress-strain relation contains two new stress terms, in addition to the term of the ideal rubber theory. Similar terms appear in the theory of "non-Gaussian networks," as corrections for the finiteness of the chains, but show a temperature dependence different from the terms due to chain interactions. Terms of both types should appear in the theory of real rubber. Accurate stress-temperature measurements on dry and swollen rubbers may permit separation of these terms from each other.

Study of Rubberlike Polymers by Nuclear Magnetism. ***B. A. Mrowca and E. Guth (Polymer Physics Laboratory, University of Notre Dame, Notre Dame, Ind.).***

The method of nuclear magnetism made possible for the first time a direct observation of the degree of "free rotation" in polymers. The actual width of the proton resonance line in uncured natural rubber has been determined at room temperature. It is about thirty times larger than the actual width in water. Cure increases the line width. For natural rubber the increase is perhaps compatible with a physical bonding rather than the usually assumed chemical cross-linking. For a butadiene-styrene copolymer the increase in line width due to cure is somewhat larger. Carbon black loading increases the line width to a lesser degree than cure. This finding is compatible with the concept of physical bonding between the blacks and the polymer chain molecules.

The effect of both cure and loading is being further investigated at low temperatures (down to —170°C.) so that more reliable conclusions can be drawn. Nuclear magnetism is also well suited for studying the change in the degree of free rotation caused by changes in chemical composition and copolymerization. Polypropylene and polypropylene oxide of roughly the same average molecular weight are compared. The polypropylene oxide exhibits a greater degree of "free rotation" about its C-O bonds than polypropylene does about the C-C bonds. Two butadiene-acrylonitrile copolymers and the isocyanate cross-linked polyester, Vulcollan, have also been studied as a function of temperature. Finally, the spin-lattice relaxation time τ temperature studies are reported for a butadiene-acrylonitrile copolymer and for raw Butyl. Conclusions about the magnitude of the barriers hindering free rotation are drawn both from the spin-lattice relaxation times and from the line width data.

Natural Rubber Compounds for Intermittent Low Temperature Service. ***W. P. Fletcher, A. N. Gent and R. I. Wood (British Rubber Producers' Research Association, Welwyn Garden City, England).***

The provision of natural rubber compounds for service at very low temperatures requires the solution of two problems. The first is concerned with the immediate changes in physical properties such as stiffness and hysteresis which occur when the temperature of the elastomer is lowered. The second arises from slow changes in stiffness, associated with crystallization, which may be significant if the rubber is stored for long periods under strain at low temperatures.

The paper is concerned with the first problem and describes a simple test method based on the torsional pendulum which may be used to measure the stiffness and mechanical loss factor of a rubber compound at temperatures down to —120°C. and is capable of following the complete transition from the rubbery to the glassy state. Rubber compounds may be characterized by a critical temperature, i.e., the temperature at which the stiffness is increased by a given factor (e.g., 2, 10, 100) with respect to the 20°C. value, or by the temperature at which a maximum occurs in the loss factor v. temperature plot.

In order to produce compounds having better over-all low temperature performance than that exhibited by a simple compound of the same elastomer, suitable plasticizers are required. Numerous materials have been examined and some are satisfactory in producing critical temperatures far below those shown by unplasticized natural rubber. Special compounding techniques which prevent molecular degradation of the rubber have been developed. These allow the addition of the necessary quantity of plasticizer while maintaining a high standard of general physical properties. Typical practical compounds of various hardnesses have low temperature characteristics approaching those of the special low temperature types of inorganic elastomers coupled with markedly superior physical properties.

Theoretical Model for the Elastic Behavior of Filler-Reinforced Vulcanized Rubbers. ***L. Mullins and N. R. Tobin (British Rubber Producers' Research Association, Welwyn Garden City, England).***

The stress-strain properties of both pure gum and filled vulcanized rubbers have been studied in simple extension and their dependence on previous deformation has been examined. It is shown that both the increased stiffness produced by fillers and the softening which results from deformation can be interpreted in terms of a simple two-phase system.

The filler-reinforced vulcanizate can be considered to be composed of zones of hard and soft rubber. On the application of a stress, most of the deformation takes place in the soft regions whose elastic behavior can be described in terms of the classical theory which has been developed for highly elastic materials. The hard regions make little contribution to the deformation but are broken down to form soft regions by the application of sufficient stress. The fraction of the rubber in the soft state thus depends upon the maximum stress previously applied.

The stress-strain behavior of the composite material can be represented most simply by a model in which the hard and soft regions are in series, and in which, to a first approximation, the hard regions are assumed to be inextensible. The observed deformation at any stress is proportional to the fraction of the rubber in the softened state.

Analysis of the stress-strain curves of filler-reinforced vulcanizates measured both before and after previous deformation has shown that it is possible to describe their course in terms of: (1) a stored energy function given by high elastic theory and appropriate to the rubber matrix; (2) a single parameter which gives the fraction of rubber in the softened state and is a function of previous deformation.

In particular, each stress-strain curve obtained on any filler vulcanizate system at elongations less than the previous maximum elongation can be superimposed on that of the rubber matrix by multiplying the strains by the appropriate factor given by the parameter above.

Non-Linearity in the Dynamic Properties of Rubber. ***A. R. Payne (Research Association of British Rubber Manufacturers, Shawbury, Shropshire, England).***

The first two sections of this paper deal with the necessity for amending the classical Newtonian equations by assuming a non-linear stress-strain curve, in order to account for the presence of a considerable amount of second harmonic of the test frequency in the restoring forces in a rubber, in both forced-vibration and positive-displacement dynamic testers. The non-linear stress-strain curve is applied also to a damped free vibration curve of

the Yerzley type, and is shown to account for the asymmetry of the envelope of the vibration curve.

The latter part of the paper obtains a relationship between the dynamic modulus of loaded rubbers and amplitude of vibration, leading to equations analogous to those used in rheology to deal with rate of shear effects in non-Newtonian liquids, and to explain the effects of fillers on the static modulus and hardness of vulcanized rubbers. A resonance curve from a resonant vibrator is analyzed and the variation of modulus with amplitude is shown to exhibit the typical thixotropic effect associated with loaded rubbers subjected to vibrations.

The last section discusses how the decrease of modulus with increasing amplitude can be attributed to two different mechanisms: (1) thixotropic breakdown of filler structure, (2) in compression, non-linearity of the stress-strain curve.

Time Dependent Effects in Tire Cords. ***J. O. Wood and W. F. Kilby (Dunlop Rubber Co., Ltd., Birmingham, England).***

The significance of time in relation to the mechanical testing and application of textile materials is discussed with special reference to tire cords. Experimental results for the creep of cotton, rayon, nylon and Terylene tire cords obtained under different conditions of load, humidity and temperature are presented. An increase in relative humidity at constant load and temperature has the effect of increasing the rate of creep of both cotton and rayon but has little effect upon that of the hydrophobic materials, nylon and Terylene. An increase in load, other conditions being constant, causes an increase in the rate of creep of cotton and rayon. The rate of creep of nylon and Terylene increases with increasing load to a maximum value and thereafter for higher loads decreases to a value which remains almost independent of load. Increase in temperature results in an increase in the rate of creep of all four materials. Heat shrinkage effects which occur in nylon and Terylene are briefly discussed.

The results obtained for rayon are discussed in the light of modern theories relating to the mechanical properties of textiles. A tentative value for the activation free energy of flow of about 30,000 cal./mole. is derived for rayon which is of the order of magnitude obtained by other authors. Other time-dependent effects, such as the dependence of breaking strength, extensibility and work to rupture of tire cords upon rate of loading are discussed and some experimental results are presented.

Developments in Testing Methods

Tear-Down Adhesion Testing. ***B. Pickup (Research Center, Dunlop Rubber Co., Ltd., Birmingham, England).***

The force required to strip adhering materials apart at constant speed fluctuates rapidly as stripping proceeds. In order to measure and record these fluctuations a testing machine must have a high natural frequency and appropriate damping. A laboratory experimental model of a suitable machine is described. It is customary to perform the tear-down test on a high inertia tensile-testing machine. Such a machine, because of its low natural frequency and light damping, cannot validly record the fluctuations in the stripping force. A number of practical tests prove this, and also show that the new machine is satisfactory. Since it is important in practice to measure the variability of the tear-down force—and to express it in statistical terms—all tear-down testing should be performed on machines incorporating the necessary frequency and damping conditions. The choice of natural frequency and damping is discussed and some suitable values quoted.

Constant Power Principle in Abrasion Testing. ***E. F. Powell and S. W. Gough (Dunlop Rubber Co., Ltd., Birmingham, England).***

Many different types of laboratory abrasion test are in regular use for assessment of wear resistance, and one underlying principle is proposed as a criterion for comparison of the validity of test design. This is the principle of constant rate of energy dissipation at the abrading surface. The details of a modification to the well-known Lambourn constant slip machine, to make it conform with the constant power principle, are described and the degree of correlation with service data on tires is given. Using this modified machine, the effects of several major variables on the abrasion loss of rubber tread compounds are reported. Extensive work on combating stickiness is outlined.

Experiments are reported with other well-known machines, such as the duPont and Bureau of Standards abraders, modified to conform with constant power principles. In addition, some speculations are put forward about relations between the work done in mechanically grinding rubber and the energy associated with the bonds which are ruptured in the grinding action. Arising from these, it is suggested that a correlation may exist between abrasion and high temperature flexibility properties of rubber.

Changes of Electrical Resistance of Rubbers Loaded with Carbon Black. ***D. G. Marshall (Dunlop Rubber Co., Ltd., Birmingham, England).***

The changes in electrical resistance accompanying the deformation of electrically-conducting natural rubber, Butyl rubber, neoprene and Thiokol F. A. have been studied under static and dynamic conditions. The results have been interpreted in terms of variations in the contact resistance between adjacent particles of carbon black.

Tire Cord Fatigue and Fatigue Testing. ***R. S. Goy (Dunlop Rubber Co., Ltd., Birmingham, England).***

The cords in the sidewall of a tire are subject to continual cyclic stresses as the tire is flexed when running. This flexing action leads to a gradual reduction in tensile strength until eventually the cords in the sidewall break. The ability to withstand this continual flexing is termed the fatigue resistance of the cord. The greater the number of flexes before failure of a particular cord, the better the fatigue performance of that cord.

Fatigue resistance of a tire is normally measured by the mileage the tire runs before failure either by running a tire on a test vehicle or on a rotating drum test machine. It is usually found that the drop in tensile strength is greatest in the inner plies of the tire, i.e., in those cords which undergo axial compression rather than tension.

Numerous methods have been proposed for evaluating the fatigue resistance of cords on laboratory machines. They all produce a flexing action on the cord and a drop in tensile strength. Although all of them have been able to detect differences amongst cords, few have reported a positive correlation with actual tire performance. It seems doubtful, therefore, whether many of the testers actually reproduce the mechanism of fatigue failure in a tire and they may produce results which are misleading. The different types of test which have been published are critically reviewed. Characteristics of tire cord and tire construction which have a bearing on the fatigue resistance of a tire are considered.

It is concluded that fatigue resistance of a cord is influenced by its being molded in a rubber-cord matrix during its flex life and that any successful laboratory fatigue tester must try to reproduce as near as possible the mechanism of failure in tire.

Pneumatic Tire Testing. ***J. I. S. Williams and R. G. Clifton (Dunlop Rubber Co., Ltd., Birmingham, England).***

The present paper presents a broad review of the newer techniques involved in tire testing. Reference is made to accelerated wear tests. Skidding tests, both on an outdoor track and an indoor ice surface, are reviewed and work on captive vehicles for the study of the effects of body roar, tire out of balance and other tire/vehicle features is discussed. Considerable work has been done both on the road and on indoor machines to correlate temperature generation under various sets of conditions. The subject of drum type testing out of doors is touched upon.

Purely indoor testing covers the long established structural tests, measurements of cornering force and self-aligning torque, rolling resistance under various tire conditions including torque transmission by the tire and tests at speeds up to over 400 m.p.h. In the discussion on high speed testing, reference is made to car and motorcycle racing tires and to aircraft tires. In connection with the latter an interesting piece of equipment is a machine powered by a Rolls Royce Merlin engine which will test two tires at a time and is capable of controlled landing and take-off sequences, it being possible to coordinate load application or removal with change of speed.

A Quick Easy Method for Determining State of Cure of Vulcanizates. *L. R. Sperberg (Sid Richardson Carbon Co., Odessa, Texas).*

One of the foremost problems confronting the rubber technologist today is the lack of a suitable test for determining state of cure of vulcanizates. As a consequence, most comparisons of pigments or compounds are clouded by inadvertent variations in states of cure of the different compounds under consideration. This has resulted in great hardship to technologists engaged in research and development compounding.

Before one can measure, one must of necessity define vulcanization. The simplest definition of vulcanization is one that defines vulcanization in terms of the property which undergoes the greatest visual change as a result of vulcanization—namely, the plasticity of the vulcanizate. Vulcanization, then, is any treatment which will reduce the plasticity of vulcanizates without materially reducing the elasticity.

The relaxed compression set test was developed on the basis of this definition. It is a modification of Method B of A.S.T.M. Designation D395. It is conducted simply by compressing a pellet 35%, holding it at this compression for two hours at 212°F., then allowing the specimen to relax for one hour at 212°F. The relaxed compression set test works for all types of vulcanizates—gum, pigmented, natural rubber, synthetic rubber, sulfur cures, non-sulfur cures, etc. The results are expressed numerically between 100 and 0, where 100 represents an uncured compound and 0 represents a totally cured compound.

When temperature coefficients of vulcanization are calculated from relaxed compression set data, the results are in agreement with published data calculated from other criteria. The relaxed compression set test offers a reliable basis for comparing physical properties of vulcanizates at equal states of cure; and, to one familiar with the test, a definite value of relaxed compression set is highly indicative of a specific state of cure.

Compounding: Theory and Practice

Nature of "Chemisorptive" Mechanisms in Rubber Reinforcement. *V. A. Garten and G. K. Sutherland (Division of Industrial Chemistry, University of Melbourne, Melbourne, Australia).*

The present state of research in the field of reinforcing rubber fillers is reviewed and it is pointed out that although a strong school of thought still maintains that the strength of bonding depends mainly on van der Waal's forces and therefore on particle size, there are a number of observations indicating the presence of reactive sites and suggesting the possibility of strong bonds of a chemical nature between filler and rubber matrix. The phenomenon of "carbon-gel" formation as foremost amongst these, is discussed as lending fresh support to the idea of chemical bond formation.

This effect, known to be most pronounced in the presence of an *unsaturated* matrix is correlated with the mechanism of vulcanization as proceeding via *free radical intermediates*. It is suggested that the formation of chemical bonds between pigment and rubber constitutes an *integral part* of the chemical cross-link formation commenced on the rubber mill and completed by vulcanization. This hypothesis is corroborated by results obtained during studies on the reactivity of pigment surfaces towards simple inorganic and organic free radicals. It is shown that active pigments react with free radicals with the formation of non-ionic bonds. Hydrophilic blacks have been prepared by the attachment of SO_3-free radical ions to the filler surface. Similarly, electrochemically produced stearate free radicals have been reacted with the surface to form hydrophobic carbons.

The "benzidine blue" free radical, being the mono-oxidation product of benzidine, easily reacted with less active pigments and thus provided a useful measure of activity. From the experiments with free radicals, the number of active sites for various fillers has been calculated and shown to cover a range of 0.01-3.1 per 100 sq. A. Multifunctional polystyrene radicals, obtained in the presence of excess oxygen, yielded cross-linked networks with carbon blanks which resisted solvent extraction. These are considered to be complete analogues to carbon gel. The statistical mechanics of the rubber network have been developed to include cross-link formation as caused by rubber-filler interaction.

It is shown that the mechanical properties of a rubber-compound that are controlled solely by the network structure are directly proportional to σ/γ, the ratio between the number of active sites per unit area and the particle radius. The effects of various fillers on photographic emulsions have been studied and the complex results obtained suggest the interference of several mechanisms, whose nature is not fully understood. It is suggested that the "Russell effect" in general may be based on ionization of the atmosphere by electrons available on surfaces of certain solid materials as indicated by experiments with free radical solutions.

Lignin as a Compounding Ingredient for Natural Rubber. *Mrs. I. Sagajllo (London Advisory Committee for Rubber Research [Ceylon and Malaya], London, England).*

The preparation and properties of natural rubber-lignin co-precipitates have been investigated. Co-precipitates differing from one another in minor respects are obtained by varying the type of lignin, the ratio of lignin to rubber and the conditions of coagulation and of compounding. Rubber-lignin vulcanizates containing 28 volumes of lignin p.h.r. have high tensile and tear strength and high resilience. Inferior abrasion resistance, however, renders lignin unsuitable as a complete substitute for carbon black in a tire tread. Data are presented which demonstrate the possibility of replacing part of the carbon black in a tire tread by a considerably larger volume of lignin without serious loss of tensile or tear strength and with positive gain in resilience.

Besides co-precipitation with latex, other methods of effectively incorporating lignin into rubber are described. Hydrated lignin, a freely flowing powder containing 35 to 60% of moisture, can be incorporated into rubber to give compounds showing a similar degree of reinforcement to co-precipitates from latex. Finely ground dry lignin, superficially hydrated by wetting with water, also exhibits reinforcing activity. Masterbatches of high lignin content capable of giving good reinforcement have been prepared from latex and lignin slurries. The loss of reinforcing activity of lignin on drying is discussed and the possibilities are considered of preparing lignin in a dry yet strongly reinforcing form which could be incorporated into rubber by conventional compounding methods.

Mooney Viscosity of Carbon Black-Rubber Mixtures. *Merton L. Studebaker (Phillips Chemical Co., Akron, Ohio).*

The principal properties of carbon black which must be considered in the study of rubber mixtures containing carbon black are (1) particle size and the related property, (2) surface area, (3) hydrogen content, (4) oxygen content and finally a property which is more difficult to evaluate but which is related to (5) the tendency to agglomerate. This latter term is referred to in the trade as a "structure" factor, and it is usually determined from oil absorption measurements. We have considered unvulcanized rubber-carbon black mixtures to be analogous to mixtures of carbon black with other, liquid media, for example, mineral oil. It has been demonstrated by Weltmann and Green that the "plastic viscosities" of concentrated suspensions obey a modified "Arrhenius equation." In this paper it is shown that unvulcanized rubber-carbon black mixtures also obey a similar equation.

The rheological properties of concentrated suspensions are profoundly influenced by long-range London-van de Waals' forces. Some of the laboratory tests by which these forces are studied by colloid chemists are specific volume of a powdered solid under pressure, sedimentation volume, oil absorption, plasticity, etc. A correlation is demonstrated between data obtained by these tests and Mooney viscosity.

A general equation is presented relating the Mooney viscosity with the concentration of carbon black and oil absorption. This equation applies to all of the data which have been examined in natural rubber. In GR-S, another term, the oxygen content of the carbon black, must be included.

Rubber Reinforcement by Resins Prepared in Latex. *J. Van Alphen (Rubber-Stichting, Delft, Holland).*

Polycondensation resins can be formed in acidified latex stabilized with non-ionic or cationic stabilizers by adding the necessary ingredients to the latex. The rubber is coagulated at the same time, and the product is neutralized, dried and worked up like dry rubber. There are indications that the resin is chemically

bound to the rubber. Rubbers prepared in this way, containing up to 30% aniline-formaldehyde resin or melamine-formaldehyde resin, have properties comparable with those of carbon black compounds, except for their light color. With 40 to 50% resin the products are tough and leatherlike and with 50 to 60% resin they somewhat resemble flexible plastics. The products with 20 to 30% resin have already been tested as sole and tire materials. Not only natural, but also synthetic rubbers, are reinforced by the resins prepared in this way.

Oil-Extension of Natural Rubber. ***G. J. Van Amerongen and H. J. C. de Decker (Rubber-Stichting, Delft, Holland).***

Numerous investigations have been carried out on the oil-extension of GR-S, such an extension being of first-rate economic importance. Knowledge of the oil-extension of natural rubber being limited, a study has been made of the technical possibilities of this subject with special reference to tread compounds. This investigation was confined to ordinary dry-mixing methods. It was found that the best procedure was first to prepare a slurry of the filler in the oil and then to add this slurry to the normal premasticated rubber on the mill or in the internal mixer. This method has the advantage of avoiding the dust normally associated with carbon black mixing.

Adding oil (Dutrex 55) to rubber decreases the tensile strength, modulus and hardness of the vulcanizate considerably. In the case of carbon black compounds, however, this softening effect of oil can be largely counterbalanced by the addition of an extra amount of carbon black. It is shown that to a normal natural rubber tread compound at least 25 parts of oil can be added without much harm to the mechanical properties if a suitable amount of carbon black is used.

Variations in the type of oil do not change the general picture very much, although some oils are disadvantageous from the point of view of aging or compatability. Extension of natural rubber with various types of bitumen along the lines mentioned above is shown to be less favorable than extension with oil, although compounds with interesting properties have been obtained.

Road tests have been carried out using tires recapped with oil-extended natural rubber. These tests prove that the wear properties of compounds containing 25 parts of Dutrex to 100 parts of rubber and those of non-extended compounds with the same type of black can be nearly identical.

Role of Intermediate Level Carbon Blacks in Rubber. ***I. Drogin (United Carbon Co., Inc., Charleston, West Va.).***

Intermediate level carbon blacks are those which have adequate reinforcement in addition to certain advantages, such as low volume cost, high loading capacity, rapid incorporation, easy mixing, fast processing, smooth fast trouble-free tubing, quick cure, accurate molding, good physical properties, high hot tensile, high resilience, lively compounds with low heat build-up, high resistance to cut and crack growth, good aging, good wear, and good electrical conductivity. In the arbitrary classification of carbon black types, the intermediate level blacks at the lower rung are the general purpose furnace (GPF) types, e.g., Sterling V, Kosmos 35/Dixie 35, and the British made blacks Kosmos 45/Dixie 45 and Ukarb 327; whereas at the higher rung they include the intermediate super abrasion furnace (ISAF) type, e.g., Kosmos 70/Dixie 70, Statex 125, Vulcan 6, and Philblack I. Ranging between the general purpose furnace (GPF) and the super abrasion furnace (SAF) types are the following intermediate level blacks: fine furnace (FF) type, e.g., Statex B; fast extrusion furnace (FEF) type, e.g., Kosmos 50/Dixie 50, Sterling SO, Statex M, Continex FF, and Philblack A, likewise known as medium abrasion furnace (MAF).

Greater interest is now being evinced by the rubber industry in the intermediate level carbon blacks due to high speeds, high power demands, economic measures and quality considerations. As a result, these blacks, when used either straight or in blends with other types of black are at present finding applications in a variety of products, e.g., passenger and truck tire treads, tire body stocks, including carcass, breaker, cushion and undertread compounds, Butyl inner tubes, mechanical extrusions complying with various durometer and tensile strength specifications, molded goods, belting, insulations, wire jackets and footwear, depending on the factory set-ups for handling and processing of the stocks, specification requirements and service performances of the finished rubber article.

The salient features of intermediate level carbon blacks are outlined in this paper with special emphasis on the processing, reinforcement and performances at high temperature. Comparisons are also made of the differences between each black and contiguous types. Recommendations for the applications for each intermediate type are given and typical compounds are shown.

Role of Particle Diameter and Linkage Formation in Rubber Reinforcement. ***A. F. Blanchard (Dunlop Rubber Co., Ltd., Birmingham, England).***

Fillers with little effect on abrasion resistance differ further from carbon blacks in having little or no tendency to introduce some form of strong-type linkage which could stiffen and strengthen the rubber at high extensions. Such linkages are here termed primary to distinguish them from secondary (weak-type) linkages, which have a range of lower strengths as revealed by breakage with applied stress, and contribute little to reinforcement. The abrasion resistance for a given filler concentration is much improved even by remarkably small numbers of primary linkages if the particles are sufficiently small; and it is comparatively insensitive to the number of primary linkages in the quantities normally obtained with carbon blacks. For instance, a considerable degree of reinforcement is obtained with the partially graphitized black known as Graphon, although this black shows drastically reduced capacity to form linkages and little change in particle diameter. The large differences in the wear resistance of vulcanizates containing different grades of carbon black must therefore be attributed mainly to the particle diameter itself rather than to the linkages formed. Moreover, primary linkages as reflected by stress-strain measurements could not explain the effect of particle diameter on reinforcement because they are unrelated to particle diameter. For good wear resistance the particles probably need to have macro-molecular dimensions, though small.

To regard the effect of particle diameter in terms of the interfacial area for linkage formation is inconsistent with the above conclusions. For a given dispersion and concentration of filler it is suggested that reinforcement is most likely to find proper expression in terms of the number of linkages per particle and the number of particles. This is expressed mathematically in a tentative, empirical form of equation designed to fit general conceptions, and to correlate roughly the abrasion resistance with filler particle diameter and with primary linkages as reflected by stress-strain measurements. The equation implies that reinforcement increases with diminishing particle diameter until an optimum is reached, and thereafter decreases to become negligible for particles of molecular dimensions.

Interaction of Rubber and Fillers During Cold Milling. ***W. F. Watson (British Rubber Producers' Research Association, Welwyn Garden City, England).***

The softening of rubber on cold milling is the physical result of a degradative process in which rubber chains are ruptured by the applied deforming forces into free radicals. Although performed mainly for the incorporation of vulcanization ingredients and fillers, cold milling is thus a rubber processing operation inducing chemical reaction between rubber free radicals and the additives.

Consideration of the structure of carbon black makes it apparent that this filler may act as a radical acceptor of a special polyfunctional type, i.e., a particle reacting with more than one half of a sheared rubber chain. Further, rubber chains attached to a carbon black particle could also undergo scission by shear and the fragments react with other particles. On this picture, one envisages a network of rubber and carbon black particles held together by chemical bonds. Although the structures of semi-reinforcing fillers and the new silicate fillers comparable in effect to carbon black are unknown, this approach to carbon black-rubber combination can be extended to them.

A network of combined filler particles and rubber would be

insoluble in rubber solvents and form a swollen gel. The insolubilization of rubber and carbon black has been reported occasionally, though no convincing experiments have been designed for interpreting the phenomenon. The experimental part of this paper is concerned with systematic measurements of the rubber-carbon black gel formed during cold milling and with further tests of the above hypothesis. The findings are all consistent with such a chemical combination of rubber and the other reinforcing agents investigated, and no comparably simple alternative explanation is apparent.

The chemical combination of rubber and carbon black contributes to the long-standing problem of the association of rubber and reinforcing fillers. The extent to which the reinforceable properties are affected becomes an immediate question. It is found that the stress-strain properties are markedly affected by this combination of rubber and filler.

Miscellaneous Technology

Abraded Filament Tire Cords. ***E. R. Gardner, A. E. Herbert and W. C. Wake (Research Association of British Rubber Manufacturers, Shawbury, Shropshire, England).***

Following the R.A.B.R.M. work on the contribution of protruding fiber ends from spun staple yarn on the adhesion of rubber to fabric, an examination has been made of the effect of abrasion on the adhesion and fatigue resistance of rubber-to-cord. The adhesion was measured by means of the H-block test and the same type of test-piece was used in fatigue experiments. A number of ways of abrading the cord were investigated and the uniformity of the abrasion assessed by a statistical technique based on sequential analysis.

The results show that static adhesion increases linearly with abrasion until an optimum is reached. The improvement under dynamic conditions is not so marked unless the cord is subjected to a dipping procedure. The combined effect of abrasion and dipping in a latex-casein mixture is greater than either treatment applied separately.

Effect of Heat Setting on the Physical Properties of "Terylene" Polyester Fiber. ***D. N. Marvin and T. J. Meyrick (Imperial Chemical Industries, Ltd., Welwyn Garden City, England).***

Synthetic fibers are finding increasing use in the rubber industry in the manufacture of rubber composite articles which involve widely different service conditions and in which a variety of physical and chemical properties assume importance. The essential properties of "Terylene" polyester fiber in fabric and cord form for these applications are discussed in relation to other materials.

However, "Terylene" filament yarn, as manufactured, and consequently the fabric and corded structures made from it, shrink on exposure to elevated temperatures. In order that the finished dimensions of the end product may be accurately defined and the physical properties of the fiber retained at the required level, it is necessary to stabilize by a process known as heat setting. Heat setting processes are discussed and information given to illustrate their significance and effect.

Due to its low moisture absorption and good chemical resistance, difficulties have been encountered in adhering "Terylene" to natural and synthetic rubbers. Experiments demonstrating the adhesion obtained between these materials using both aqueous and solvent bonding systems are described.

Wave Phenomena in Tires at High Speed. ***D. M. Turner (Avon India Rubber Co., Ltd., Melksham, Wilts., England).***

Much experimental evidence on the formation of waves at high speed in tires was published in a paper by Gardner and Worswick. Following these results a theory has been developed which explains all the available evidence qualitatively and much of it quantitatively. The wave formation is shown to be initiated by the kinetic energy of the tread as it leaves the road surface on rotation of the tire. If the velocity of rotation of the tire exceeds a critical value, then this energy manifests itself in the form of a wave.

The wave formation produced is characterized by three properties: (a) the modes of vibration excited, (b) their respective wavelengths, and (c) their initial amplitudes. The theory shows how these properties depend on the following conditions and basic factors: (1) speed of rotation of the tire, (2) load and inflation pressure, (3) dimensions of the tire, (4) construction of the tire, (5) casing shape, (6) tread contour and pattern, and (7) physical properties of the materials composing the tire.

The mathematical analysis proceeds to show how the energy of the wave travels in the tire at a certain velocity away from the point of separation of tread and road. This leads to an expression for the power consumption due to the wave which agrees well with experimental results. A thorough understanding of these phenomena is needed by the tire engineers to design the tires required by modern high speed transport.

Tread Wear and Fuel Consumption of Tires. ***H. C. J. de Decker, R. Houwink and G. J. Van Amerongen (Rubber-Stichting, Delft, Holland).***

The factors, wear and fuel consumption should be studied jointly whenever a comparison is made between different types of tire. An experimental study of passenger tire treads along these lines was started. Other very important factors, like carcass life, could not yet be included in this investigation. The purpose of the investigation was twofold: (a) to compare ordinary synthetic and ordinary natural rubber passenger tread compounds, and (b) to evaluate the influence of variations in natural rubber compound composition on these factors. It is clear that this program is very extensive. Only a beginning has been made. Two American passenger cars were used for systematic testing in standard wear tests. Fuel consumption measurements were carried out on one of these test cars during special runs in which the car was equipped with appropriate measuring apparatus. All these tests were designed on the basis of mathematical statistics and the results were evaluated accordingly.

Letter to the Editor

Dear Sir:

The April, 1954, issue of RUBBER AGE contained a report from the Washington Rubber Group about a talk I delivered before that body on March 1. I would like to clarify several statements which appeared in that report, as follows:

(1) Referring to production of natural rubber in Indochina, I never said that actual production in 1953 was 100,000 tons. This figure referred to production capacity; actual production was 74,000 tons.

(2) I did not say that 1945 production was triple what it was in 1953. Rather, I stated that since 1945, one-third of the cultivated plantations could not be utilized because of war damage.

(3) I never said that the question of color of Indochinese rubber caused it to be sold at prices lower than would otherwise be possible.

(4) I would also point out that the addition of chemical additives does not result in a "reinforced" rubber in the sense that one usually means by the word "reinforcement."

I would like to call these inaccuracies to the attention of your readers and I would like to refer them to a more complete and accurate presentation of my views which also appeared in your April, 1954, issue, on page 100.

J. LE BRAS

Paris, France
May 18, 1954

The Rheology of Rubber Solutions and Suspensions

II—Latex and Latex Compounds

By LOUIS LEAMAN

Magic Chemical Co., Brockton 2, Mass.

IN the previous paper of this series, we discussed the flow properties of rubber-solvent systems *(32)*. A review of work in this field was presented, in addition to a discussion of the Brookfield Viscometer and its use in our laboratory. Rheograms were used to show the practical importance of this type of study in the rubber industry. In the present paper, we shall discuss the rheology of latex and latex compounds in a similar manner. It is the purpose of this paper also to show the importance of instrumentation in solving rheologic problems.

Originally, the word "latex" signified an aqueous rubber emulsion obtained from natural sources, chiefly from the Hevea rubber tree. Now the word has a much wider meaning, including also the many types of manufactured aqueous emulsions of elastomeric and plastic polymers. To list just a few of the industrial applications of latex and latex compounds, there are:

(1) Manufacture of GR-S and other polymers by emulsion polymerization, where wide viscosity changes occur during the course of the polymerization *(9)*.

(2) Dipping processes, where the rheological properties control the time and speed of dwell and the rate of deposition *(35, 43)*.

(3) The manufacture of foam rubber.

(4) Gelling processes, where viscosity changes occur rapidly during processing.

(5) Latex paints, whose rheological properties govern the working properties of the paint *(8, 16, 17)*.

(6) Adhesives, where machine applications give rise to special flow conditions.

(7) Paper converting.

Colloidal Properties

The flow behavior of latex systems must be explained in the light of their colloidal properties. Uncompounded latex is a liquid-liquid dispersion, or oil hydrosol. The two immiscible liquids are the elastomer globules forming the internal phase, and water, the external phase. At the interface are various emulsifying or stabilizing agents, such as proteins and soaps. It is this interface which determines the rheological properties and stability of the system.

The adsorbed-film theory seems to be a practical and workable explanation of the conditions existing in simple latex systems *(10)*. The emulsifying agent is a third phase separating the oil and water phases. Both oil and water are adsorbed on their respective sides. The type of emulsion formed depends on the magnitude of the surface tension on each side of the film. The side with the higher tension becomes concave and a droplet is formed. The interfacial tension of the two liquid phases in equilibrium is related to the surface tension of each (Antonoff's rule). [The Pratt Process is the only commercial process in the latex industry in which both water-in-oil and oil-in-water systems are involved *(36)*. This process is now used for the manufacture of reclaimed rubber dispersions].

The theory also postulates that the emulsifying agent must be capable of forming a film in order to act as an emulsifying agent or stabilizer. The stability of the emulsion system depends on the nature of this film. While this theory presents a mechanical picture of colloidal stability, we must remember that the electrical charge on the film is also important. It has been stated that "when no chemical reaction takes place between electrolyte and emulsifying agent, the electrical charge on the dispersed globules does not determine stability or type" *(10)*.

In considering the theories underlying the colloid properties of latex, it is also important to study the effective depths of these interfacial surfaces. McBain *(34)* considers that colloidal surfaces have a range of action extending far beyond monomolecular thickness. Such forces as the van der Waal's forces may be used to explain the structural effects found in thixotropic or pseudoplastic latex systems. Van Olphen *(44)* has also considered these forces in rheological effects.

Any modifications made in rheological properties must be done with consideration for the stability of the system. Colloidal stability in its broad meaning indicates the ability of a hydrophobic colloid to keep from coagulating or changing irreversibly. Creaming and thickening cannot be considered destabilizing conditions *(33)*, since such phenomena can be reversed.

Creaming and thickening agents very often improve the stability of a latex system. Care must be exercised that the same influences which cause thickening, or other reversible rheologic change, be not carried so far that the system coagulates. The principles underlying the colloidal stability of natural rubber latex have been summarized by E. G. Cockbain *(11)*.

The stability of latex is due to the electric charge on the interfacial film and to the degree of hydration. Thickening is accompanied by increase in particle size. The rate of increase of particle size or rate at which the particles adhere to one another is an indication of the degree of instability.

The time factor is significant in the stability of latex systems. Stability changes with time. Concurrently, rheologic changes occur. Environmental changes, such as temperature and electrolyte addition, are also significant.

Stabilizing agents are of four general types: (1) Highly-hydrated, gel-forming colloids, such as gums and gelatin; (2) Colloidal electrolytes (cationic and anionic), such as soaps and sulfonated oils; (3) Non-ionic surface-active agents, such as fatty alcohol-ethylene oxide condensates; (4) Solid particles, if they may be adsorbed

Note: This paper was presented before the Division of Rubber Chemistry, American Chemical Society, Boston, Mass., May 29, 1953.

on the surface of the globule. Thus, the stability of these systems is due to the presence of an adsorbed layer or film at the interface, consisting of a coherent, mechanically strong gel, an orientated monomolecular layer, or a layer of tightly-packed solid particles *(10)*. The same types of colloidal materials are used to make controlled changes in rheological properties.

In considering the colloidal properties of natural latex which may be of rheologic interest, we must not overlook the so-called "lutoid" or yellow fraction of latex *(22, 26)*. Recent studies indicate that this yellow fraction may have an important bearing on flow properties of natural latex.

In summary, the forces and conditions present at the interface in latex compounds which may influence rheologic behavior are: (1) mechanical film, (2) electrical charges, (3) hydrated water, (4) van der Waal's forces, and (5) loose clumping or structure (ramifying aggregates).

These same general principles apply to synthetic latices and to latex compounds containing additives. In general, the synthetic latices have a much smaller particle size than Hevea latex. The relationship to stability of this smaller particle size, and hence much larger surface area, is that much larger amounts of stabilizing agents are required in these systems *(56)*.

Rheology of Uncompounded Latex Systems

Maron and co-workers *(30, 30a, 31, 39, 40)* have done exhaustive work on the rheology of GR-S and other uncompounded latex systems. While the results are reported on GR-S Latex Types III and V similar results were obtained with other latices. In concentrations up to about 60% of solids, both these GR-S types behave the same. Up to 25% solids, the latices are simple liquids. Above concentrations of 25%, these latices are complex, pseudoplastic liquids. Between 25 and 45% concentrations, a single exponential flow equation may be used for both low and high shearing stresses. Above 45% concentrations, two different flow equations must be used, one for low shearing stresses and another for high shearing stresses. With Type V, above a concentration of 60% (0.60 to 0.62 volume fraction) there was a decrease in viscosity with increase in volume fraction. This is probably due to the setting-in of a degree of structure which restricted Brownian movement and allowed flow along definite planes.

Polydisperse systems, as typified by mixtures of GR-S Latex Types III and V show flow at concentrations higher than corresponding monodisperse systems. (Both Types III and V are highly monodisperse). An increase in the heterogeneity of the particle size distribution leads to much tighter packing of the particles.

No thixotropic properties were found by Maron. It is only when these latices are compounded that thixotropic properties may appear.

Control of Flow Properties—Thickening

Most commercial latex applications require some form of control or regulation of the flow properties of the latex compound. The simplest methods for control are the addition or removal of water, addition of stabilizing agents, and the use of thickening agents. This control usually has two stages: (1) the compound is brought to a desired rheologic state, and (2) it is then prevented from changing its rheologic properties (until desired). In the first stage, specific materials such as "thickening agents" may be added to the compound. In the second stage, additives may be used which prevent further thickening due to chemical reaction, coalescence or flocculation. Other methods used to control viscosity are the addition of antagonistic salts and change of temperature. Complications arise when unwanted flow changes occur (for example, gelling or thickening of natural rubber latex compounds containing zinc oxide, or loss of thixotropy in latex paints).

We shall first consider the controlled, desirable thickening. All thickeners show marked colloidal properties in their own water dispersions. While many of these materials add to the stability of the system, others may cause coagulation if not used carefully. In determining the efficacy of a thickening agent, its effect on stability must also be considered. Creaming may occur. Rearrangements take place within the system, such as increased hydration of the dispersed particles. It is this change in structure which produces rheologic changes. A study of the colloidal properties of dispersions of these thickening agents by themselves cannot predict their behavior in the latex systems. However, such considerations do help qualitatively in postulating reasons for their behavior.

Typical commonly-used thickeners are sodium bentonite *(2, 3, 7, 24)*, methyl cellulose *(48)*, citrous pectates *(54)*, sodium polyacrylate *(4, 49)*, tapioca starch, polyvinyl alcohol and soybean protein *(8)*. These are all hydrophilic colloids. We will consider a few of them in detail.

Sodium polyacrylate shows sharp, easily controlled, increases in viscosity with most types of latices. A simple liquid is quickly changed to a complex liquid on addition of controlled amounts of dilute aqueous solutions of this polymer. When these systems are properly prepared, they show little change in final rheologic properties over periods of time *(50)*. Results of multipoint viscosity determinations show that pseudoplastic liquids result. Sodium polyacrylate is a polyelectrolyte. Studies indicate that electrical effects and a long-chain structure are important in the thickening action *(20, 38)*.

The effect of methyl cellulose as a thickening agent has been studied *(48)*. Marked creaming occurs with cellulose derivatives. However, colloidal stability is not impaired.

Bentonite (Wyoming montmorillonite, sodium bentonite, Volclay) is another widely-used thickening agent. The commercial types of bentonite which are suitable for latex compounding are those which swell to many times their volume when placed in water. Their chemical structure differs distinctly from non-swelling bentonites. The swelling bentonites have sodium ion as the exchangeable base, rather than magnesium, calcium or hydrogen *(14, 24, 27)*.

Aqueous suspensions of sodium bentonite are highly thixotropic. Stable compounds containing this agent can be made with controllable rheologic properties. It has less tendency to cream natural latex, as compared with the thickening agents previously discussed. Its compounds also show quicker "breaking" action when pressure is applied to the film. This "quick-breaking" property is utilized in adhesives and in the "flow-casting" process for manufacturing objects of rubber latex *(51)*.

There is a maximum amount of bentonite which may be added without causing coagulation. When amounts up to this maximum are used, thickening takes place with formation of a thixotropic, loose-aggregate structure. If more than the maximum is added, an unstable type of thickening occurs. A compound containing such an excess, if allowed to stand without stirring, will flow, as shown by a smooth rheogram. When stirred strongly this compound will coagulate immediately. This is illustrated in Figures 13, 14 and 15.

An example of unwanted viscosity change is found in the use of zinc oxide in natural latex. Zinc oxide is necessary in the vulcanization of latex products but reacts chemically with other ingredients, causing partial or complete distabilization and thickening *(18, 21, 28)*. Certain surface-active agents have been found to be of practical help in reducing this action.

Instrumentation

It is widely accepted that rheology is an excellent tool in helping the chemical technologist improve formulation and processing qualities of many industrial products. This use of rheology as a laboratory tool has depended on the development of adequate instruments for measuring rheologic properties.

In the latex industry, the value of the rotating cylinder viscometer was recognized by the Division of Rubber Chemistry *(15)*. Published methods for testing latex gave a detailed procedure for the use of the capillary tube method for testing viscosity. However, the limitations of this method were recognized, and the use of the coni-cylindrical viscometer was mentioned as having a wider range of applicability, especially for complex liquids *(29, 42)*.

The American Society for Testing Materials offers only an efflux tube method for testing viscosity of latex *(5)*. However, A.S.T.M. is actively interested in developing rheological procedures using rotating cylinder viscometers. R. H. Walsh has presented a detailed report of current practice in the latex industry *(53)*. It was found that the Brookfield Viscometer was more widely used than any other commercial type.

Brookfield Viscometer Adopted

The Reconstruction Finance Corporation has adopted the use of the Brookfield Viscometer as the standard for determining viscosity of GR-S latices *(47)*. The technique for using the Brookfield viscometer has been described in the first paper of this series *(32)*.

The viscosities of non-Newtonian liquids are not, in general, derived mathematically with the Brookfield viscometer. However, the rheograms are of value because it is their shape which tells important rheologic properties. The Brookfield Viscometer is a precision instrument, and rheograms can be reproduced consistently.

The work on latex rheology done in our laboratory is best discussed by the use of rheograms. Our problems are of a practical nature, involving control of latex compounds during manufacture and assuring users of optimum rheologic properties in their work. Some of these problems will be discussed in the experimental section.

Thixotropy

Thixotropy is one of the most common and most troublesome of the anomalous flow properties encountered in this work. Thixotropy is a reversible gel-sol condition resulting from structural effects within the liquid. It is the most widely studied phenomenon of rheology. Its complexity arises from the fact that it depends not only on the composition of the liquid, but also on external factors, such as degree of agitation and time. While there are many alternative theories and procedures for measuring thixotropy, standard, practical methods are available.

The classical work on thixotropy has been done by Freundlich *(19)*. Thixotropy is present in colloidal systems in which large amounts of the liquid can be held adsorbed around the dispersed particles. When at rest, the particles show no Brownian movement and form a chain or network of loosely packed particles. The immobilized particles may be held by far-reaching electrical forces, by thickly solvated layers, or by the manner of packing. Non-spherical particles are more favorable to thixotropic conditions than spherical particles.

Mooney *(41)* considers a thixotropic compound which he investigated as consisting of aggregates of solid particles broken up by stirring. During subsequent recovery, loose aggregates are formed which contain much trapped water. The rate of recovery depends on the previously applied shearing stress. Mardles and de Waele *(27)* consider that thixotropy is due to frictional forces between particles and is also dependent on the character of the interfacial film. Their experiments show a relationship between thixotropy and changes in the interfacial film.

Alfrey *(1)* shows how the thixotropy of a system can be studied thoroughly by use of three-dimensional graphs. The three factors are shear strain, stress and time. Pryce-Jones *(46)* has discussed instruments of his own design for the study of thixotropy.

The problem of a definition for degree of thixotropy has not been settled satisfactorily. It has been proposed that a "thixotropic index" be calculated by using the Brookfield Viscometer *(17, 45)*. The thixotropic index would then equal viscosity in centipoises at 12 rpm divided by viscosity in centipoises at 60 rpm. Dale *(12)* has suggested the difference between two readings on a torsion viscometer as the "thixotropy". However, these suggestions do not define the problem completely.

Experimental Work

In charting thixotropy in the latex compounds studied, the "hysteresis loop" method of Green was used *(23)*. Determinations have been made with two models of the Brookfield Viscometer: Model RVF operating at speeds of 2, 4, 10 and 20 rpm, and Model RVF operating at speeds of 10, 20, 50 and 100 rpm.

Thixotropy can be detected on rheograms such as this by plotting the dial readings on ascending speeds and then on descending speeds. It is assumed that, at equilibrium at the highest speed, the gel is completely broken down to a sol, which then shows the properties of a simple liquid. Such a simple liquid gives a straight-line curve. There is some question as to whether it is not more advantageous to start the plot at the highest speed and then work down to the lowest speed. Another suitable method for plotting thixotropy is described by Hoekstra and Fritzius *(25)*.

Figure 1 is a rheogram of a natural latex compound containing a high percentage of soft clay. Thixotropy is quite evident.

Figure 2 is a rheogram of a commercial latex paint. For this type of product, a certain degree of thixotropy is very essential. One of the chief problems in the formulation and practical use of latex paints is to retain the desired degree of thixotropy throughout the shelf life of the paint. Thixotropy in a paint delays settling and hard packing of suspended pigments during shelf life. It also helps the non-sagging properties of the wet film.

Figure 3 is a rheogram of the same paint with additional thickening agent supplied by the manufacturer. This addition changed the apparent viscosity, but not the type of thixotropy. The area within the two curves has been suggested as a definition for the amount of thixotropy, since a more thixotropic material would have a wider bulge.

Figure 4 is the same latex paint as in Figure 2. These

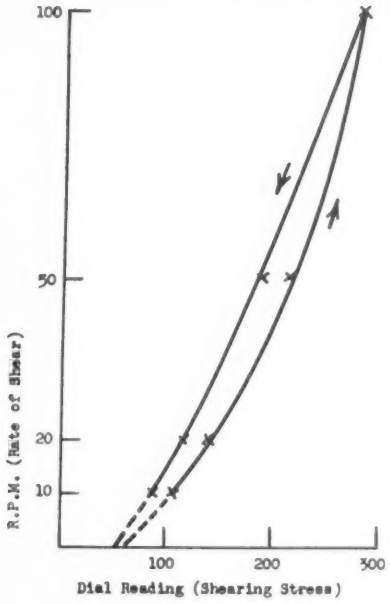

FIG. 1 — Natural latex compound containing a high percentage of soft clay.

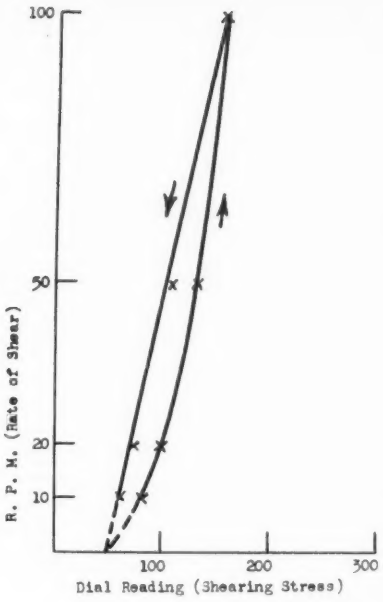

FIG. 3 — Commercial latex paint with thickening agent added to the compound.

readings were taken with the viscometer operating at a top speed of 20 rpm. The shearing force produced at this speed was not enough to cause complete thixotropic breakdown. Therefore, the gel structure kept building up on the down-speeds even faster than it had broken down on the ascending speeds.

Figure 5 is that of a GR-S Latex Type IV compound greatly thickened with sodium polyacrylate. The solids content is 42%. Thixotropy is indicated. This type of compound is used as a spreader compound for combining or impregnating fabrics.

Figure 6 is a comparison between two types of GR-S Latex. The Type IV Latex had been thickened to 59.5% solids by evaporation of water.

Figure 7 shows the effect of adding a very small amount of water to a neoprene latex compound. The structural effects are greatly reduced. This compound consisted of Neoprene Latex 842A, 50 parts, and a

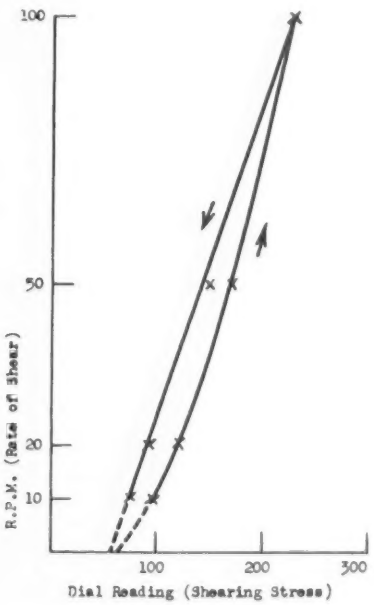

FIG. 2—Commercial latex paint. A certain degree of thixotropy is very essential.

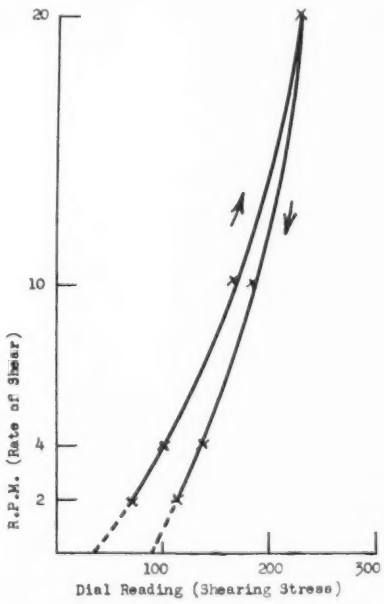

FIG. 4 — Commercial latex paint. Readings taken with viscometer operating at top speed.

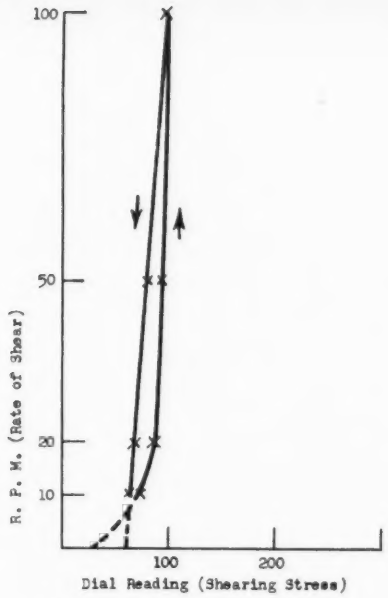

FIG. 5 — Type IV GR-S Latex compound greatly thickened with sodium polyacrylate.

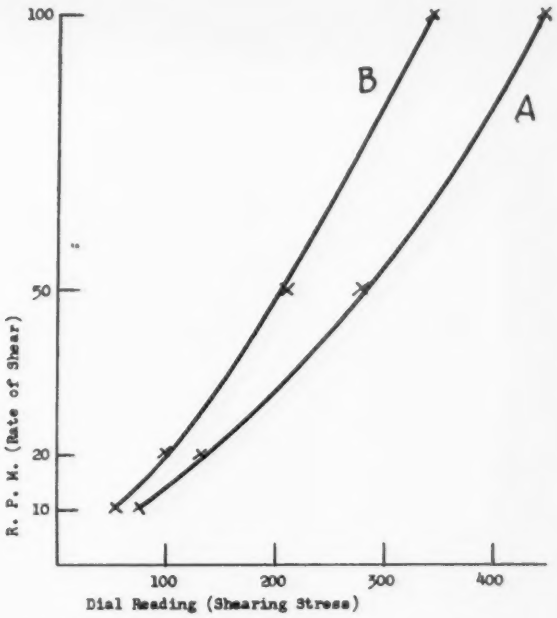

FIG. 7—Effect of adding a small amount of water to a neoprene latex compound. The structural effects are greatly reduced.

commercial resin tackifier emulsion, 50 parts. One percent of water was then added.

Figure 8 shows two rheograms of natural latex adhesives. Curve A is that of an unknown composition. It was possible to prepare a similar product having the same application properties and the same rheologic structure.

Figure 9 is a rheogram of natural latex compound containing a large amount of resin emulsion and thickening agent. This product does not show thixotropic properties. The thickening agent is polyacrylic acid.

Figure 10 is the rheogram of a polyvinyl acetate emulsion such as used in high-speed paper coating or laminating. The flow properties are those of a simple liquid even though the solids content is 57%. This type of compound is necessary on the type of roller machine by which the adhesive is applied.

Figure 11 is that of a GR-S Latex Type IV with

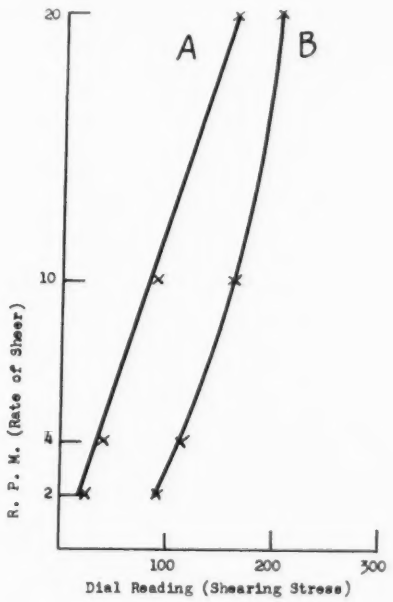

FIG. 6—Comparison of GR-S Latex Types IV and V.

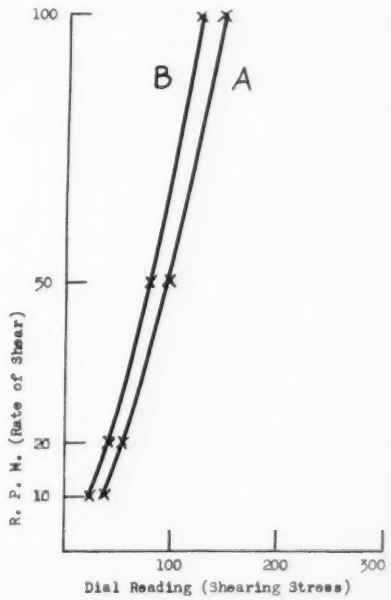

FIG. 8—Comparison of two natural rubber adhesives.

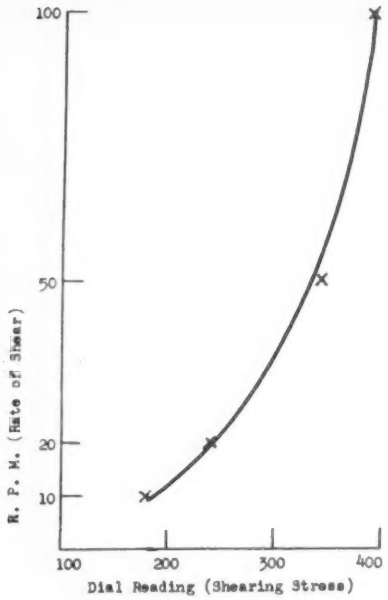

FIG. 9—A natural latex compound containing a large amount of resin emulsion and thickening agent.

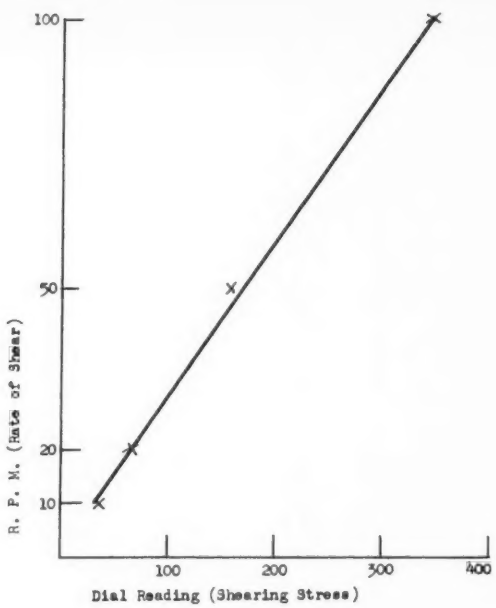

FIG. 11—Type IV GR-S Latex with minor amounts of compounding ingredients. A type used for fabric impregnation.

minor amounts of compounding ingredients. This is used for fabric impregnation. The flow properties are those of a simple liquid. The compounding ingredients are casein and polyacrylic acid.

Figure 12 shows a natural latex-tapioca starch compound. The compound consists of the following: 60% natural latex (50 parts), 15% neutral tapioca starch solution (50 parts).

Figure 13 is a rheogram of a latex-bentonite compound. The formulation is: 60% natural latex, 66 parts; Volclay Bentonite KWK (5% aqueous solution), 12 parts, and water, 12 parts. The rheogram was made three days after preparation of the compound and after the container was shaken by hand. This shows typical thixotropic structure, similar to Figure 4.

Figure 14 is a rheogram of the same compound made eighteen days later. Curve A was directly made after violent shaking. The curve is almost Newtonian. Curve

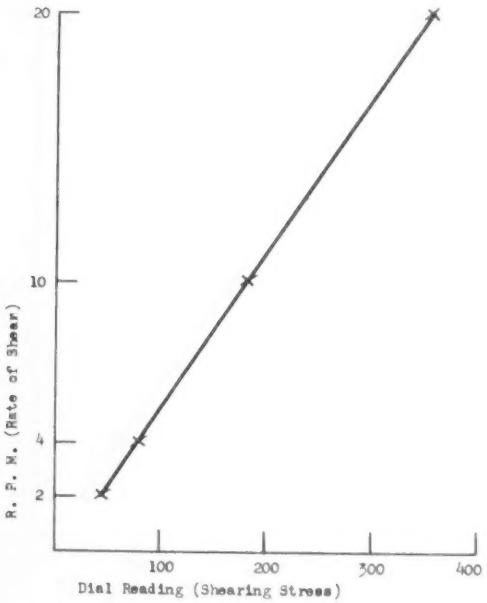

FIG. 10—A polyvinyl acetate emulsion such as used in paper coating.

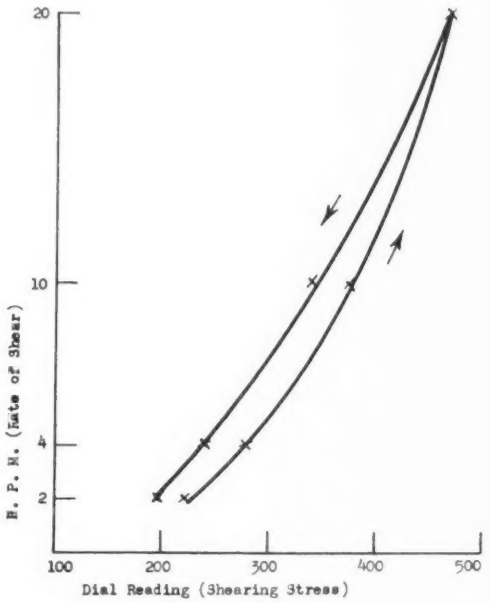

FIG. 12—A natural latex-tapioca starch compound.

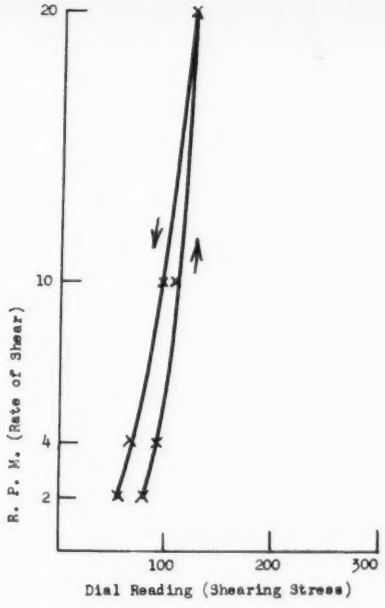

FIG. 13—A typical latex-bentonite compound.

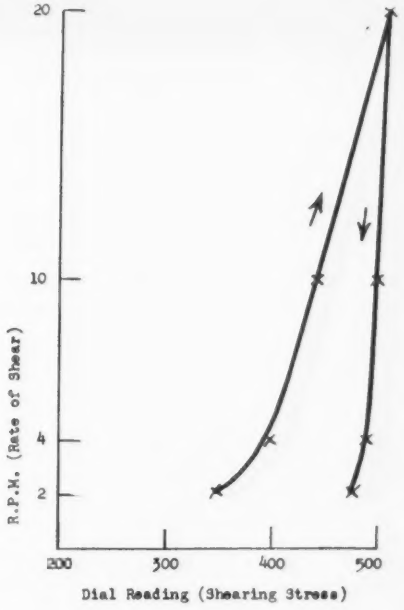

FIG. 15—A latex-bentonite compound after three days.

B was made ten minutes later. This latex-bentonite compound showed no decrease in stability after several weeks.

Figure 15 is a rheogram of a similar compound. The formulation is: 60% natural latex, 50 parts; Volclay Bentonite KWK (5% aqueous solution), 37 parts, and water, 13 parts. This rheogram was taken three days after compound preparation and after hand shaking. Eighteen days later, this compound coagulated after being hand shaken.

Figure 16 is a rheogram of a natural latex compound which contains a high percentage of coarse filler (ground tire scrap). Because of the gross particle size of the filler (30 mesh), it was felt that this compound was not truly thixotropic. The coarse particles were merely pushed aside by the rotating bob. This was confirmed by visual inspection.

Figure 17 shows a set of rheograms for benzene-in-water emulsions of different concentrations of benzene. This chart is taken from Clayton *(10)*. The results are similar to those obtained with latices of varying solids concentrations.

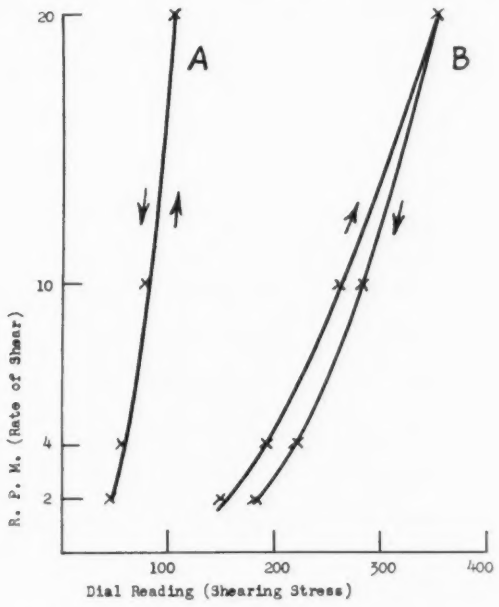

FIG. 14—A latex-bentonite compound after eighteen days.

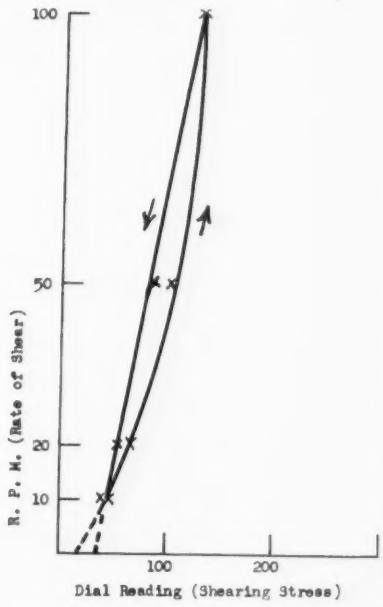

FIG. 16—A natural latex compound containing coarse filler.

Further work along the lines indicated is being conducted in our laboratory. The results will be reported.

ACKNOWLEDGMENT

The author wishes to thank Mr. Robert Kravetz and Mr. Martin Tishler of the Magic Chemical Company for the interest they have shown in this work. He also wishes to thank Mr. W. B. Brookfield and Mr. Richard Minard of the Brookfield Engineering Laboratories for their valuable suggestions.

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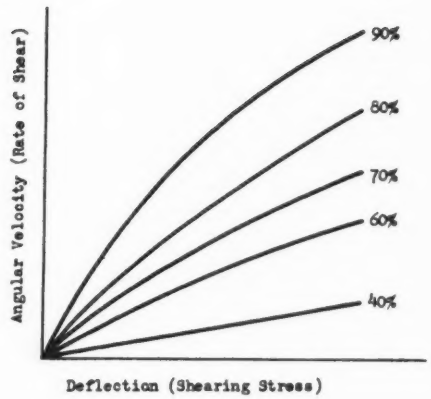

FIG. 17—Benzene-in-water emulsions of different concentrations of benzene.

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Bakelite Fluorothene Resins. Bakelite Co., 300 Madison Avenue, New York 17, N. Y. 8½ x 11 in. 16 pp.

Recent property and fabrication data on Bakelite fluorothene resins are compiled in this booklet. Much information on the new, heat-resistant resins, now in commercial production after five years of process development by the company is offered. Recommendations on extrusion, injection and compression molding of Bakelite fluorothene resins are included in a section on fabrication for the engineer and manufacturer. Applications of the versatile resins include monofilaments for the textile industry, extruded insulation for wires and cables, and numerous molded products.

Liquid Emulsion Polybutadiene as a Softener for GR-S

By R. W. LAUNDRIE and B. G. LABBE

Government Laboratories, University of Akron, Akron, Ohio

Liquid polybutadienes varying in weight-average molecular weight from 3,600 to 39,000 were prepared by an emulsion process at 122 F. Evidence is offered that indicates these materials with molecular weights of about 25,000 or greater tend to vulcanize with sulfur in gum stocks to give appreciable tensile and elongation values. Polymers with molecular weights of below 10,000 yielded slabs from the liquid materials that had little strength or extensibility, but apparently are vulcanized. Their study as possible adhesives is suggested. When compounded as softeners with GR-S, there is little evidence to indicate that these low molecular weight, unsaturated polymers, enter into the cross-linked structure of the vulcanizate, as they give stress-strain results about like those of polymers masterbatched with Circosol-2XH.

IN an effort to determine the value of liquid polybutadienes of varying molecular weight as softeners for GR-S, a series of investigations was made. These investigations produced some interesting results, as will be tabulated below.

Experimental Procedure

Polybutadienes were prepared at 122°F. in accordance with the GR-S persulfate-catalyzed polymerization formula, except that considerably greater quantities of chain regulator (DDM, commercial n-dodecyl mercaptan) were employed and the hydrocarbon conversions were lower. Procedures for charging and removal of the unreacted monomer from the latices were the same as those prescribed for GR-S. Recovery of the polymers from the latices was accomplished by flocculating the latices with sodium chloride and sulfuric acid followed by a thorough washing with caustic soda and dissolving the polymer in neohexane or benzene. The antioxidant, phenyl betanaphthylamine, was added to the dissolved polymer. Removal of the solvent by distillation yielded clear, dry, viscous, sticky polymers. Summarized data for the experimental polymers are given in Table I.

TABLE I—EXPERIMENTAL POLYMERS

Polymer No.	Hydrocarbon Conv. %	DDM parts	Dilute Solution Viscosity [a]	Approx. Molecular Weight [b] $\times 10^{-3}$	Freeze Point [c] —C.
20R2	51.3	2.0	0.58	39.0	65
20R5	52.5	2.0 [d]	0.55	36.0	70
20R3	50.0	4.0	0.43	25.0	67
20R4	54.0	6.0	0.22	8.9	70
20R6	51.0	10.0	0.18	7.0	68
20R7	50.7	10.0 [d]	0.17	6.4	70
20R8	42.5	10.0	0.15	5.2	70
20R9	29.0	10.0	0.12	3.6	70

(a) By the method of Mullen and Baker *(1)*. (b) Calculated according to the relationship: Log molecular weight = 4.93 + 1.49 Log DSV *(2)*. (c) Point at which a modified Gilmore needle, loaded to 100 grams per square millimeter, did not indent surface of polymer. (d) Cs tertiary mercaptan used in place of DDM.

Experiments with X-418 GR-S: X-418 GR-S was compounded using experimental "softeners" 20R5, 20R6, 20R7, and 20R9 as well as using 0 and 5 parts of BRT No. 7 as controls. The basic recipe was:

Ingredients	Parts
X-418 GR-S	100.0
EPC black	50.0
Zinc oxide	5.0
Softeners	0 to 15
Sulfur	2.0
Captax	1.5

TABLE II—PROCESSING PROPERTIES

Softener No.	Parts	Mooney Values, ML-4 Raw	CBS	Compd.	Mill Shrinkage %	Roughness	Mill Processing Index [a]	Garvey Die Extrusion Rating [a]
20R5	5	48	83	60	43	16	10.0	12.5
	10	48	84	52	45	16	10.2	12.5
20R6	5	48	82	57	43	14	9.9	12.5
	10	48	88	48	43	13	10.3	12.5
	15	48	92	40	42	12	10.3	12.0
20R7	5	48	79	55	42	14	7.7	11.5
	10	48	79	46	42	14	8.4	11.0
	15	48	80	39	43	14	8.5	12.0
20R9	5	48	87	54	46	18	10.4	12.0
	10	48	81	46	44	16	9.9	11.5
	15	48	74	36	44	15	9.3	11.5
BRT No. 7	0	48	83	73	44	23	10.2	12.0
	5	48	81	63	39	15	9.6	13.0

(a) Mill processing index, the total of ratings for carbon black stiffening, banding time, breakdown time, mill shrinkage and roughness. An index of 0 represents the best processibility and a value of 20 the poorest *(3)*. (b) Extrusion rating, by the method of Garvey, Whitlock and Freese *(4)*. An index of 4 represents the poorest and 16 the best extrudability.

Processing data (Table II) showed decreasing compound Mooney and roughness values, but little or no change in mill shrinkage, processing index or extrusion index with either increased concentration or decreasing molecular weight of the experimental softeners at any given concentration of softener. Except for the compound Mooney viscosity values, which were 5 to 10 ML-4 points lower, the values for the mixes with the experimental softeners were comparable to those of the controls made without softener, or with 5 parts of BRT No. 7.

Stress-strain data (listed in Table III) show decreasing modulus and tensile strength values and increasing elongation with increased softener content. Modulus, tensile strength and elongation values at the 30- and 60-minute cures were lower for stocks containing 5

TABLE III—STRESS-STRAIN VALUES FOR POLYBUTADIENES WITH X-418 GR-S

Softener No.	Parts	300% Modulus (lb./sq. in.) 30	60	90	Tensile Strength (lb./sq. in.) Min. Cured at 292°F. 30	60	90	Elongation (%) 30	60	90	Set (%) 30	60	90	Optimum Cure * (min.)
20R5	5	460	1130	1530	1030	2510	3010	580	580	530	16	15	12	79
	10	320	840	1140	710	2170	2710	570	580	550	13	14	12	78
20R6	5	420	980	1390	1020	2580	3100	580	530	500	15	11	11	75
	10	250	720	1000	620	1950	2580	610	590	540	14	15	13	81
	15	150	500	710	420	1410	2030	680	620	600	22	14	12	82
20R7	5	480	1130	1486	950	2500	2820	550	540	480	14	11	9	76
	10	270	750	1060	730	2100	2630	680	640	570	19	15	12	79
	15	180	530	780	410	1600	2160	670	650	590	15	13	11	85
20R9	5	400	1050	1410	1030	2650	3080	600	580	530	15	14	11	77
	10	250	710	980	540	1900	2430	600	600	550	15	11	11	80
	15	160	460	676	300	1340	1820	620	620	590	16	11	11	86
BRT No. 7	0	720	1540	1980	1540	3190	3530	550	510	460	14	12	11	69
	5	530	1240	1520	2000	3650	3250	730	640	510	25	18	11	67

* From modulus versus time of cure curves using values for vulcanizates cured 30, 45, 60, 90 and 150 minutes at 292°F.

parts of the experimental material than those obtained on vulcanizates with 5 parts of BRT No. 7. All stress-strain values and rate of cure. With either softener, the same magnitude when 5 parts of experimental softener or BRT No. 7 were used. When compared with GR-S compounded without additive, the vulcanizates containing 5 parts of liquid polybutadiene show lower modulus and tensile strength values but better (higher) elongation. No difference between vulcanizates containing the polybutadiene softeners of different molecular weight was noted at any given concentration. In general, the optimum curing time was slightly longer for the stocks containing the experimental softeners.

Gehman *(5)* low temperature test data in Table IV reveal a general, although somewhat erratic, improvement in freeze point with vulcanizates containing increased concentration of the experimental polybutadienes compared to those that contained 0 to 5 parts of BRT No. 7. Some improvement in the freeze point of vulcanizate was indicated with decreased molecular weight of the polybutadiene.

Experiments with X-720 GR-S: X-720 GR-S was compounded using experimental softener 20R7 (molecular weight of 6400) or a petroleum processing oil, Circosol-2XH, as shown in Table V. At the same curative levels, the liquid polybutadiene and Circosol-2XH-softened stocks acted similarly, exhibiting similar stress-strain values on 90 minute vulcanizates are of about the tensile strength was much poorer than the unsoftened X-720.

Acetone extractions of the uncured and cured compounded polymers of Table V showed that the polybutadiene was not completely extractable by acetone whereas the Circosol-2XH for the most part was; therefore, it is reasonable to conclude that at least a portion of the polybutadiene has been rendered insoluble by vulcanization.

Examination of Results

Black Recipes: Polybutadiene polymers 20R4, 6, 7 and 8, varying in molecular weight from 5200 to 8900, when mixed in a recipe specifying 100 parts of each of these polymers, 40 EPC black, 5 zinc oxide, 2 sulfur

TABLE IV—GEHMAN FREEZE TEST RESULTS FOR POLYBUTADIENES WITH X-418 GR-S

Min. Cured at 292°F	Softener No.	Parts	T_{10}	T_{100} (Minus °C.)	Freeze Point
60	20R5	5	40	49	48
90		10	40	49	51
60	20R6	5	48	56	53
90		10	47	55	53
150		15	47	58	53
60	20R7	5	39	47	47
90		10	42	49	49
150		15	42	50	51
60	20R9	5	43	53	53
90		10	46	54	55
150		15	43	54	54
45	BRT No. 7	0	40	48	46
60		5	38	46	47

TABLE V—STRESS-STRAIN VALUES AT 77°F FOR POLYBUTADIENE WITH X-720 GR-S

Compound	A	B	C	D	E
X-720	100	100	100	100	100
20R7	—	15	—	15	—
Circosol-2XH	—	—	15	—	15
EPC black	40	40	40	40	40
Zinc Oxide	5	5	5	5	5
Altax	1.75	1.75	1.75	6	6
Sulfur	2	2	2	10	10
Total	148.75	163.75	163.75	176	176

	Min. Cured at 292°F.	Stress-Strain Values at 77°F.				
300% Modulus, lb./sq. in.	25	380	80	160	2030	1020*
	50	830	320	390	—	1890*
	100	1200	520	640	—	—
	200	1570	710	840	—	—
Tensile strength, lb./sq. in.	25	2250	720	1060	2480	2540
	50	3710	1910	2280	2070	2050
	100	3820	2430	2940	1780	2080
	200	3560	2880	2800	2190	2050
Elongation, %	25	860	1080	1060	350	350
	50	710	870	860	220	210
	100	590	730	730	160	180
	200	490	670	610	170	160
Set, %	25	24	35	33	10	11
	50	18	21	21	4	4
	100	13	14	16	3	3
	200	9	13	11	2	2
Acetone extractables, % (Uncured)		7.3	10.2	16.2	16.0	22.1
Acetone extractables, % (Cured 100 minutes)		7.4	7.5	15.8	7.3	14.7

* 200% Modulus values.

TABLE VI—EXAMINATION OF POLYBUTADIENES IN BLACK RECIPES[a]

Polymer (100 parts)	20R4					20R3				20R5			
Molecular weight × 10^3			8.9			25				36			
SRF black	—	—	—	—	—	25				25		25	25
EPC black	40	40	40	40	40	—				—		—	—
Zinc oxide	10	10	12	5	10	3				3		3	3
Sulfur	6	12	24	24	24	10				10		10	10
Altax	6	12	24	24	24	10				10		10	6
Stearic acid	—	—	—	—	—	2				2		2	2
	Stress-Strain Values at 77°F. (Specimens Cured in 0.025 inch gage, Molds)												
Min. cured	210	210	210	210	210	60	120	240	60	120	240	25	25
Temp. of cure, °F.	292	292	292	292	292	292	260	230	292	260	230	292	292
Tensile strength, lb./sq. in.	b	b	b	b	b	160	260	130	240	640	110	720	450, 540
Elongation, %	—	—	—	—	—	30	40	20	50	100	40	40	30, 50

(a) Ingredients mixed in beakers. (b) Yielded non-extensible stocks with Shore A hardness of 95 to 100.

and 1.75 Altax and heated in a laboratory mold at 292°F. for 100 minutes showed no visible evidence of curing. The mixtures did not set-up, nor have any strength or elasticity.

Polymers 20R3, 4 and 5, with molecular weights of 9,000 to 36,000, were mixed in a recipe specifying 100 parts of polymer, 40 EPC black, 5 zinc oxide, 12 sulfur, 12 Altax and 3 stearic acid and heated for 60 minutes at 292°F. Hard, porous, brittle slabs with very little strength and no elasticity resulted.

Additional Tests

Additional tests at much higher sulfur and accelerator levels were made with the results shown in Table VI. The two polybutadienes of higher molecular weight, 20R3 and 20R5, yielded vulcanizates with poor tensile strength and very little elasticity; of the latter two, the highest molecular weight polymer, 20R5, showed the highest stress-strain and elongation values.

Gum Stock Recipes: Polybutadienes 20R4, 6, 7 and 8, varying in molecular weight from 5200 to 8900, when mixed in a recipe specifying 100 parts of each of these polymers, 3 zinc oxide, 30 sulfur, 6 Altax and 2 stearic acid and heated at 292°F. yielded gelatine-like masses characterized by low strength and little elasticity. Results of additional tests in gum stock recipes are shown in Table VII. Only the higher molecular weight polymers showed appreciable tensile strength and elasticity.

Adhesives: The raw polybutadienes varied from fluid to semi-solids, and varied in stickiness and shortness of threading. No tests were made to test these materials as adhesives, but their appearance should warrant such testing for those interested.

Summary

The liquid polybutadienes, when added to standard compounds on the basis of 5 parts per 100 parts of GR-S polymer, show more softening effect than BRT No. 7 when added in the same proportion. The adding of these experimental softeners causes lower modulus and tensile strength values and greater percentage elongations. With the longer cures the differences were less noticeable, which may indicate the possibility of some vulcanizing effect by the liquid polybutadienes. As the proportions of softeners were increased, the stress-strain values became poorer. A very slight improvement in low-temperature flexibility properties was noted for the stocks to which the experimental softeners had been added.

The vulcanizing properties of the liquid polybutadienes are erratic. However, the fact that stress-strain slabs could be prepared from recipes containing no other polymer than these experimental materials indi-

TABLE VII—EXAMINATION OF POLYBUTADIENES IN GUM STOCK RECIPES[a]

Polymer (100 parts)	20R6	20R4	20R3			20R5							
Molecular wt. × 10^3	7	8.9	25			36							
Zinc Oxide	3	3	3	3	3	3							3
Sulfur	10	10	10	10	10	10							10
Altax	6	6	6	6	6	6							10
Stearic acid	2	2	2	2	2	2							2
Min. cured	60	60	60	120	50	50	50	25	60	120	240	25	50
Temp. of cure, °F.	292	292	292	260	292	292	292	292	292	260	230	292	292
Tensile strength, lb./sq. in.	b	b	100	b	570	1360	1520, 1380, 1510	660	240	640	110	420	870, 690, 690
Elongation, %	b	b	50	b	120	110	140, 130, 130	100	50	100	40	90	100, 110, 110
Shore A hardness	—	—	—	—	c	70	—	—	—	—	—	—	—

(a) Mixed in beakers. (b) Yielded porous slabs low in strength and extensibility. (c) Too porous to measure.

cates a vulcanization effect. The 1500 pounds per square inch tensile values obtained with 20R5 in a gum recipe, together with elongation values of about 100%, are evidence that the slabs were vulcanized and not just a pressed slab. No test sheet could be prepared from a compound made with Circosol-2XH as a replacement for the liquid polybutadiene.

SPECIAL NOTE

The work discussed herein was performed as a part of the research project sponsored by the Reconstruction Finance Corporation, Office of Synthetic Rubber, in connection with the Government Synthetic Rubber Program.

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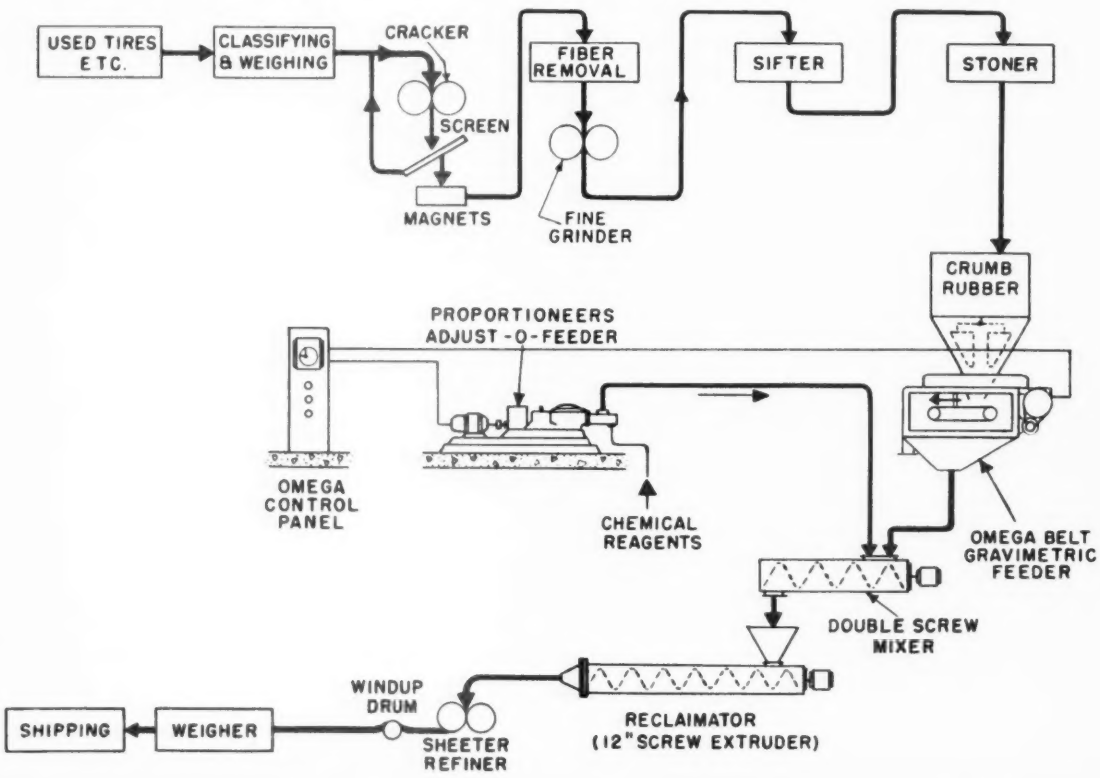
A Method for the Continuous Processing of Reclaimed Rubber

OMEGA Machine Co. and Proportioneers, Inc., both of Providence, R. I., have released a flow diagram for a continuous method of devulcanizing rubber in a few minutes instead of ten hours. The process is accomplished by accurate proportioning and feeding of crumb rubber, oxido-plasticization agents and softening oils, utilizing an Omega Belt Gravimetric Feeder and a Proportioneers Adjust-O-Feeder operating from an Omega Control Panel.

In application, old tires which have been cracked on a corrugated roll mill to ½-inch size are screened, move over magnetic separators for removal of steel bead wire and pass into a mechanical fiber removal system. The resulting fiber-free scrap is further ground to 20-mesh crumb, sifted, rescreened for removal of non-magnetic glass, stone, etc., and conveyed to large storage bins.

A Belt Gravimetric Feeder continuously weighs and feeds this crumb rubber into a special double screw mixer. Proportioneers pumps continuously meter oxido-plasticization agents (mercaptans, monosulfides, disulfides, etc.) and softening oils into the same mixer.

The resulting pre-mixed crumb is continuously fed into a Reclaimator (12-inch screw extruder having heating and cooling zones) where the rubber crumb is compressed, worked mechanically and heated to 350°F., under which conditions devulcanization takes place. The extruded rubber sheet is then cooled, wound up, cut to proper thickness, dusted with whiting and made ready for shipment.



Editorials . . .

London Conference

LONDON, England

YOUR editor has had the privilege of attending the Third Rubber Technology Conference in London and his comments on this four-day international meeting (as well as a factual report) appear elsewhere in this issue. The term "privilege" is used with a full understanding of the word, because attendance at the meeting permitted daily contacts with noted rubber technologists from the four corners of the world, and enabled one to grasp the particular problems which face the rubber manufacturing industry, no matter where the goods are produced or where they are sold. It is somewhat surprising to find that the basic problems are almost identical, whether the manufacturer is located in Akron or in Timbuctu.

It is difficult to say whether delegates to these international meetings secure greater good from their attendance at the technical sessions or from the informal discussions that always occur when delegates meet outside the conference room, or at the social functions which are so inevitably a part of these meetings. As Dr. A. van Rossem, one of the delegates from Holland and one of the most respected of our international rubber technologists, so aptly put it: "The delegates go home wealthy in rubber knowledge but far richer in their rubber friendships." It can also be assumed that more than one business transaction took place in the halls and corridors. After all, there was a liberal sprinkling of businessmen among the almost seven hundred registered delegates.

There is no gainsaying the fact that international meetings of any kind, including those devoted solely to a specific field or industry, as in the present instance, result in a better understanding between people and therefore between nations. The Marquess of Salisbury, patron of the Conference, put it in these words: "In particular I would like to welcome those who have come from overseas. I hope they will not only benefit from their visit from a purely practical point of view, but form friendships which may prove enduring and fruitful long after the end of the Conference. I hope they will benefit not only the cause of rubber, but also that of international understanding."

This same theme was reiterated from time to time by some of the delegates, but shaped in different form. For example, a delegate at one of the social functions referred to the British technologists as the "raw rubber" and termed the technologists present from overseas as the "reinforcing ingredients." Another visualized a blending of all of the delegates into a "rubber nationality, with cross-links all over the world." A more serious note was interjected by Lord Baillieu, head of the great Dunlop organization and president of the Institution of the Rubber Industry, who pointed out that sometimes competitive positions are created only in the mind and only personal contacts can dispel them. For example, he deprecated the antipathy which exists in some quarters between natural and synthetic rubbers, emphasizing the point that both of these materials were vital to society, a point which has frequently been made in these columns.

The technical papers themselves, as outlined elsewhere in this issue, covered the gamut of rubber technology. The total number presented—50—seemed adequate for a conference of this kind, but it is suggested that future conferences allow considerably more time for discussion since on several occasions it was necessary for session chairmen to cut the discussions short because of time limitation. Such action, extremely necessary because of the time factor, is to be lamented, since the occasions for discussion on an international basis are so few and far between. It might be advisable to lengthen the time of the conferences to five full days, allowing each author about 15 minutes for a summary of his paper, and considerably more time for discussion. When one travels thousands of miles to a conference, an additional day adds no special hardship.

As indicated, the papers ran the full range of rubber technology, including chemistry and physics, which is to be expected at a conference held at an international level. It was evident, however, from the attendance at the session devoted to the theory and practice of compounding, at which almost every seat in the great assembly hall was filled, that practical, day-to-day problems of production are of paramount interest to the majority of delegates at these affairs, a point made by Dr. W. J. S. Naunton, Chairman of the Conference, in his closing remarks. It may also be suggested, then, that at least two sessions and possibly more be devoted to these practical problems at future conferences. Perhaps a five-day meeting would permit such sessions.

The great progress made in rubber technology since the Second Rubber Technology Conference was held in London in 1948 was evident from the papers presented at the latest conference. Since these are covered in the factual report published elsewhere in this issue, they will not be further commented upon in these columns. However, the progress being made in the production of rubber goods was perhaps best summed up by Dr. J. van Alphen, of Holland, in a paper on reinforcing rubber by resins in the latex. Referring to the quality of soles produced from such reinforced rubber, he said the time has come when instead of re-soling old shoes it is necessary to re-shoe old soles.

Highlights Sidelights *of the News . . .*

July, 1954

The RFC action in increasing the price of Butyl rubber, certain GR-S latices and black and oil-black master-batches caught some in the trade unawares (page 551) . . . Many attributed the bullish tendencies in the natural rubber market, in part, to the price increases in synthetic rubber . . . Some comments on this competitive relationship between natural and synthetic rubber, made recently by H. C. Bugbee, president of the Natural Rubber Bureau, strike an interesting note at this time (page 588).

There is still a long road ahead for all the companies which have been found eligible to bid for the government's synthetic rubber facilities before a successful contract can be negotiated (page 551) . . . Eligibility was determined by a bidder's placement of a deposit up to $250,000, and by a promise to keep the plants in condition to produce rubber for ten years after sale—a national security requirement.

Recent reports from Brazil indicate that a serious shortage of raw rubber exists (page 555) . . . It is reported that many plants have been forced to suspend operations and that others have shut down completely or are on the verge of doing so.

A successful meeting was reported by our editor, M. E. Lerner, who attended the Third Rubber Technology Conference in London (page 521) . . . We are particularly proud that ours was the only American journal to have a representative at this important conference.

The suit recently filed by Goodrich against U. S. Rubber charging infringement of tubeless tire patents was the second filed in the past year or so . . . Back in May of 1953, Goodrich filed a similar suit against Firestone . . . U. S. Rubber answers that it believes the patent in question is invalid (page 567).

The Crown-owned Polymer Corp. at Sarnia, Ont., Canada, has set out on a program of renovation and expansion to cost $3,400,000 in 1954 . . . Polymer has also announced a $2,000,000 modification of its ethylene producing facilities at Sarnia (page 572).

NEWS REPORTS and Industry Activities

ALL SYNTHETIC PLANT BIDDERS FOUND ELIGIBLE; RFC ANNOUNCES PRICE RISE FOR BUTYL RUBBER

THE Rubber Producing Facilities Disposal Commission announced on June 11 that all thirty-six companies which had submitted fifty-six proposals and nineteen alternate proposals for the purchase of the government's synthetic rubber facilities had been found eligible to negotiate for the facilities. Holman D. Pettibone, chairman of the Commission, stated that bidders will be called as promptly as appointments can be made, with negotiations starting with the high bidder for each facility.

Laurence B. Robbins, Administrator of the Reconstruction Finance Corporation, announced that effective 12:01 A. M., June 30, the price of Butyl rubber was being increased 1¢ per pound to 23¢ plus the applicable uniform freight charge. Price increases ranging from 1 to 4¢ per pound were effected on certain GR-S latices. An increase of ¼¢ per pound was also announced in the selling price of carbon black masterbatches and oil-carbon black masterbatches.

In announcing the eligibility of all bidders who had submitted proposals prior to the deadline date of May 27, Mr. Pettibone emphasized that negotiations will be conducted under a closed-door policy, the commission neither disclosing prices offered for the facilities nor publicly identifying the facilities sought by any one company.

Mr. Pettibone stated: "We are pleased that every bidder is eligible to discuss his proposal with us. In forthcoming negotiations, industrial executives will be given ample opportunity to present their position and views on the facilities in which they are interested. However, it is obvious that with the large number of bidders, considerable time will elapse before all companies can be heard."

Disposal Conditions

Under the disposal conditions, if a company fails to acquire its first choice of a plant, it has the right to negotiate for any other facility in that particular category. The categories in the entire disposal program include 13 copolymer plants, 8 petroleum-butadiene plants, 2 alcohol-butadiene plants, 1 styrene plant, and miscellaneous other facilities.

Although negotiations will start with high bidders, the Commission pointed out that under the legislation passed by Congress authorizing the sale of the plants, other criteria must be considered, such as financial responsibility and technical competence.

In addition, the law requires clearance by the Attorney-General that disposal of the synthetic facilities will be in accord with the establishment of a free and competitive industry. Finally, negotiations completed by the Commission must be submitted to Congress for approval.

RFC, in announcing the price increases for certain of the synthetic rubbers produced in the government-owned plants, stated that it will no longer be necessary for the purchaser of black masterbatched rubber to furnish the Office of Synthetic Rubber with a waiver of claims if he desires his order shipped bareback. It was also stated that concurrently with the change in prices for the black masterbatches and the oil-black masterbatches, the allowance of ½c for each bale shipped bareback has been discontinued.

The price increases apply to about 30% of the synthetic rubber—on a tonnage basis, sold by RFC. Butyl rubber, taking a 1c raise, accounts for about 10% of sales; GR-S latices, raised 1 to 4c, account for about 9%; while the carbon and oil-carbon black masterbatches, up ¼c, account for something over 11%.

Mr. Robbins stated that the increases were effected to reflect a sales price commensurate with the cost of production. The prices were raised enough to recover cost plus a normal profit, he declared.

No change was made in the present price of 23c a pound for dry GR-S, which accounts for about one-half of RFC sales—or in the somewhat lower prices, ranging from 17¾ to 19½c per pound, for oil-masterbatch GR-S. This latter type accounts for about 20% of sales.

According to the trade, the price change was not entirely unexpected, in view of reports that high-placed Treasury Department officials were considering a price boost to increase Federal revenues.

Last July, the price of Butyl rubber was raised 1¼c, and there had been a 1c increase in freight charges. Since that time, however, prices had remained stable.

Mr. Robbins stated that synthetic rubber sales, in the fiscal year ended June 30, had netted the government a profit of "about $46,000,000". This compares with a record $62,000,000 for the previous fiscal year. Last February, before the slump in synthetic rubber demand hit RFC, officials were publicly expressing hopes for a $70,000,000 profit in fiscal 1954.

On June 21, Mr. Robbins announced that RFC's sales of synthetic rubber for the month of September will be approximately 48,000 long tons, an increase of almost 10% over indicated August sales. August production will be 39,000 long tons, an increase of 3,200 long tons over that anticipated in the previous month. Production in September will be continued at the 39,000 ton level.

GR-S Production and Sales

The following table sets forth an estimate of RFC's production and sales for the three months' period ending September, 1954. These figures include the oil used in oil-extended rubbers, but exclude the carbon black used in carbon black masterbatches.

Month	Production	Sales
July	35,800	38,000
August	39,000	44,000
September	39,300	48,000

The action by the RFC in increasing prices came as that agency's last official act. All functions of RFC under the Rubber Act of 1948, together with all property, powers, rights, contracts and liabilities held by RFC in connection with the government's synthetic rubber program, have been transferred to the Federal Facilities Corporation, as of midnight, June 30.

The Federal Facilities Corporation, as the new agent of the government with respect to the synthetic rubber program, is vested with all the responsibilities, powers and rights previously held by RFC. Beginning July 1, 1954, all contracts and business in connection with the government's synthetic rubber program should be executed and conducted in the name of the Federal Facilities Corporation, 811 Vermont Avenue, N.W., Washington 25, D. C.

SYMPOSIUM ON O-RINGS FEATURES ASME RUBBER-PLASTICS MEETING

A symposium on "Rubber O-Rings" featured the meeting of the Rubber and Plastics Division of the American Society of Mechanical Engineers held on June 22 at the Hotel William Penn in Pittsburgh, Penna. The meeting was held in conjunction with the semi-annual meeting of the parent group which was held on June 20 to 24.

The Rubber and Plastics Division meeting was held in morning and afternoon sessions, with the morning session devoted to plastics, while the afternoon session consisted of three papers comprising a symposium on "Rubber O-Rings." Maurice Morton (Akron University) served as chairman of the morning session, while Walter Tepper (Martin Rubber) was chairman of the afternoon session. Approximately 80 members and guests attended each of the two sessions.

At the morning session, Norman A. Skow (Synthane) presented a paper entitled "Dielectric Breakdown Properties of Thermosetting Laminates". The speaker explained that to establish safe operating loads, tests for the endurance limits of dielectric strength were run on each of several standard grades of thermosetting plastic laminates plotting voltages against time.

The data thus obtained indicates, the speaker stated, that for a given thickness and atmospheric condition, a maximum voltage exists below which failure will not occur. Tests of this type yield results which are valuable to the design engineer in determining the proper grade and thickness of material for use as insulating parts in electrical equipment.

The second paper at the morning session was entitled "Impact Plastics with Responsibilities", presented by Paul E. Fina (Fiberite). This paper attempted to encourage the usage of properly engineered impact thermosetting plastics.

"Weather Aging of Styrene and Phenolic Plastics" by C. Howard Adams and J. R. Taylor (Monsanto) was the title of the third paper presented at the morning session. The paper was presented by Mr. Taylor, who stated that commercial styrene and phenolic plastics were exposed outdoors for four years in Arizona, Florida and Massachusetts. Pigmentation markedly improved the weathering resistance of styrene plastic. Arizona with its high ultra violet radiation intensity was the most severe location for styrene. The semi-tropical weather of Florida did the most damage to the phenolic, Mr. Taylor stated.

Papers at Afternoon Session

"Designing With O-Ring Seals" was the title of the first paper presented in the symposium "Rubber O-Rings". The author, David R. Pearl (United Aircraft), offered a discussion of the basic principles of O-rings. He also outlined how to properly design for O-rings and offered a summary of their advantages and limitations.

The second paper in the afternoon session was entitled "Compounding Principles Involved in the Production of O-Rings" by Douglas Messenger (Garlock Packing). Mr. Messenger observed that compounding techniques for O-ring compounds are largely governed by such requirements as good physical properties, particularly low compression and tension sets, and good aging characteristics. They should exhibit low, but positive, volume changes in the medium employed and must operate satisfactorily in both static and dynamic applications under the prescribed conditions.

The choice of the elastomer is largely governed by the medium against which the O-ring is to perform, Mr. Messenger stated. The media most frequently encountered have been petroleum-base fluids, hydrocarbon fuels and more recently, non-inflammable fluids—either water-base or esters. Since rightly or wrongly more applications are packed by nitrile rubber compounds than by compounds of other elastomers, the discussion was based largely on nitrile rubbers.

A study of the volume change characteristics in representative fluids (A.S.T.M. Oils Nos. 1 and 3, A.S.T.M. Fuel Types 1 and 3, and two Ucon fluids) and other properties of nitrile rubber compounds, having varying acrylonitrile content and varying amount of plasticizers, show how these variations affect the properties. These data are not necessarily new or original but they are present in a single package to provide the compounder with a guide that will help him predict results and at the same time suggest necessary modifications.

Mr. Messenger recommended that the so-called "super aging" type of curing system be used. It is to be noted that his discussion considered only compounding principles. The scope of his talk did not include finished compounds or specification compounds.

The third paper in the symposium, and the last in the afternoon session, was entitled "Swelling and Drying of Fuel O-Rings" by R. A. Clark and R. M. Kell of the Battelle Memorial Institute, Columbus, Ohio. This paper concerned itself with an investigation which had been made of the rates of swelling and drying of confined and unconfined fuel O-ring packings at various temperatures. The object of the work was to explore the possible shortening of a lengthy fuel O-ring test procedure (Specification MIL-P-5315) by employing higher swelling and drying temperatures.

Most of the previous work of other investigators on the swelling of rubber does not appear to be directly related to this problem, it was said. Some of the work reported has been fundamental in nature, dealing with such problems as the free energy of mixing of solvent and polymer, internal pressures, and relations between the degree of cross-linking and swell. These theoretical treatments of the interactions between polymers and solvents have been aimed chiefly at explaining the chemical nature of polymers, rather than in predicting rates of swell in particular solvent systems, the authors emphasized.

It was noted that somewhat more practical approaches to the problem of rubber swell have been made, but unfortunately, the data are not considered applicable to the fuel-type O-rings under consideration.

Names Three Vice-Presidents

N. C. Babcock, E. E. Fogle and H. D. Kinsey have been appointed vice-presidents of the Carbide and Carbon Chemicals Co., New York, N. Y. Mr. Babcock received the B.A. degree from Cornell University. He joined the Sales Department of the company in New York in 1924. In 1935, he was made manager of chemical sales and in 1944 was appointed manager of the Industrial Chemicals Division. Mr. Fogle was graduated from Marietta College in 1930 and joined the company as a research fellow at the Mellon Institute of Industrial Research in Pittsburgh, Penna. He became Chicago district sales manager in 1940, western division sales manager in 1944, and sales manager of the Industrial Chemicals Division in 1953. Mr. Kinsey received the M.S. degree from Massachusetts Institute of Technology and joined Carbide in 1924, serving in the company's West Virginia plants. In 1934, he was made superintendent of the chemicals plant at Whiting, Ind., and in 1944 he became plant manager at Oak Ridge, where Carbide was bringing the atomic energy plant into operation. In 1946, Mr. Kinsey moved to New York to become works manager.

Hi-Miler Rib Truck Tire

A new popularly priced truck tire, designed for the replacement field and described as "outstanding in its class," has been announced by Goodyear Tire & Rubber Co., Akron, Ohio. Termed the "Hi-Miler Rib," the tire is manufactured in a wide range of sizes (6.00-10.00) covering the majority of trucks in all types of service. The new product, according to the company, is designed especially for the vast market comprised of owners of one or two trucks, who demand a popularly priced replacement tire. These one and two vehicle owners number more than 5,000,000 and represent some 94% of the nation's truckers. The new tire replaces the company's former "Marathon" truck tire, but incorporates definite improvements over the former product. Highlighting these improvements, it was pointed out, is the superior strength of the new tire's body, which is constructed of a new rayon cord, treated by the company's recently-developed multi-million dollar process for controlling tire cord stretch. Other advantages of the new tire over its predecessor include an improved tread, and a tread design which provides better traction.

Acquires U. S. Industrial Line

Effective June 1, the Archer-Daniels-Midland Co., Minneapolis, Minn., has acquired the resin plants, formulae and trademarks of the U. S. Industrial Chemicals Co., a division of the National Distillers Products Corp. The complete U. S. Industrial synthetic resin line includes: "Arochem" modified maleics and phenolics; "Arofene" pure phenolics; "Aroflat" for special flat finishes; "Aroplaz" alkyds and allied materials; "Aropol" copolymer modified alkyds and polyesters; ester gums, and processed natural resins. For the present, orders will continue to be handled through U. S. Industrial's offices and sales representatives.

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BRAZILIAN INDUSTRY REPORTS ACUTE RAW RUBBER SHORTAGE

According to recent reports, Brazil, once the world's only producer of rubber, is closing down factories for lack of raw rubber. The Firestone plant in Sao Paulo, for example, has announced: "We have been forced to suspend production of tires, tubes and repair materials because we have no longer in stock the fine rubber necessary for manufacture of these products. Production will remain suspended until we receive enough fine rubber to allow us to resume production on a normal basis and with at least some assurance of not being obliged to interrupt our activities again."

Brazil's rubber shortage is not a new situation. It has been much discussed and for the past few years has been getting more acute. Now, for the first time, it is said to have reached a stage where not only Firestone but other plants as well are on the verge of shutting down.

Although Brazil's annual consumption of raw natural rubber is only about 44,000 tons, the Amazon region that once supplied the world produces only 24,000 tons. Efforts to raise production have had some effect, but the country has not succeeded in attaining a self-supporting basis.

One concession in the Amazon Valley, once operated by Henry Ford, is said to have about 1,000,000 rubber trees suitable for production but is getting rubber from only a little more than half of them because of difficulties in getting sufficient laborers.

More Efficient Operations

Two years ago, technicians of the Pirelli, Firestone and Goodyear organizations made a joint report to the Brazilian Ministry of Finance saying that more efficient operation could double Brazil's rubber yield without the planting of a single additional tree. They recommended efforts to settle more workers in the rubber area and to teach them more efficient handling of the latex, most of which, they said, was lost in the process of collection.

At the end of 1952, there was much talk of rapidly growing rubber production, and Gabriel Hermes Filho, president of the Amazonia Credit Bank, asserted that reports of the amount needed for this purpose had been greatly exaggerated. Production for 1952 was the biggest in forty years, he said, and he announced plans for financing of Brazilian producers and a ban on the importation of rubber.

Industrial consumption continued to outstrip production. Factories complained of having to slow down to fit in with the spasmodic shipment of rubber from the plantations. Now, many of these factories are trying to get rubber from the Far East.

Indonesian representatives in Rio de Janeiro have stated that they know nothing of any shipments of rubber from their country to Brazil. According to one press report from Rio de Janeiro, however, 4,000 tons of Indonesian rubber are expected in Brazil within the next few weeks. This small amount would still not settle the long-term problem in keeping the factories open, Brazilian sources state.

PROMOTION OF LUXENBERGER AND WARD ANNOUNCED BY U.S. RUBBER

E. A. Luxenberger

G. T. Ward

Eugene A. Luxenberger has been elected vice-president of the U. S. Rubber Co. and appointed general manager of its Footwear and General Products Division, effective July 1. Gregg T. Ward has been named to succeed Mr. Luxenberger as assistant general manager of the division. Mr. Luxenberger started with U. S. Rubber as a production worker at the company's plant in Williamsport, Penna., 33 years ago. In 1932, he was transferred to the Mishawaka, Ind., plant as manager of industrial engineering. Successive promotions brought him appointment as factory manager in 1943. Eight years later he became assistant production manager of the division. In 1953, he was appointed assistant general manager of the Footwear and General Products Division. Mr. Ward has been general sales manager of the division since 1951. He started work with U. S. Rubber early in 1925 as a sales clerk in the San Francisco branch where he was later promoted to manager of footwear sales. After a year as sales manager of the Baltimore branch, he was made sales manager of the nation-wide branch sales organization. He served as general merchandise sales manager of the company from 1949 to 1951.

Bearfoot Sole Appoints Wong

Bearfoot Sole Co., Inc., Wadsworth, Ohio, has announced the appointment of Philip Wong as manager of new products development. A native of Shantung, China, Mr. Wong was educated at Christian College in Shantung and China Training Institute in Nanking. He later served as dean of Missionary High School in Peking, until it was shut down during the Sino-Japanese War. In 1937, Mr. Wong came to this country as an exchange student. He was graduated from Madison College in 1941 and won a government science scholarship which enabled him to continue his studies. In 1945, he served briefly with the Firestone Tire & Rubber Co., and in July of that year joined Bearfoot Sole.

Virginia Rubber To Build Plant

Some 300 to 400 workers will be employed at the new Virginia Rubber Corp., soon to be built at Iron Gate, Va. Work on the plant, a subsidiary of the H. O. Canfield Co., Bridgeport, Conn., has not yet begun. William Ryan, works manager of the plant, stated that the new plant will have 37,000 square feet of floor space, although only about 20% would be utilized at the start. Working in three shifts, the plant will turn out close-tolerance sealing for automobiles, as well as machinery and other items such as stoppers, crutch tips and flush balls for commodes. It will be primarily a fabricating operation, manufacturing parts for other industries.

A.I.C. Elects New Officers

The American Institute of Chemists at its annual business meeting held this year on May 13 at the Berkeley-Carteret Hotel in Asbury Park, N. J., elected new officers. Dr. R. P. Dinsmore (Goodyear) was chosen president-elect. He will take office in May, 1956, and will serve for two years. Dr. Lloyd Van Doren, chemical consultant with the firm of Watson, Leavenworth, Kelton & Taggart of New York City, was re-elected secretary for a two-year term. Dr. Frederick A. Hessel (General Aniline & Film) was re-elected treasurer, also for a two-year term. Dr. Donald B. Keyes (Arthur D. Little) is current president of the Institute, having succeeded Lincoln T. Work. Dr. Keyes' term ends in May, 1956. At the meeting on May 13, the following members were elected as councilors to serve for three-year terms: Dr. Emil Ott (Hercules Powder), Dr. William J. Sparks (Standard Oil Development), and Dr. John R. Bowman (Mellon Institute).

Edgar and Attapulgus Merge

Effective June 23, the Edgar Brothers Co. merged with the Attapulgus Minerals & Chemicals Corp. The name of the new company is Minerals & Chemicals Corp. of America. All correspondence which formerly would have been addressed to the Edgar Brothers Co. should now be directed to the Minerals & Chemicals Corp. of America, Edgar Division, Metuchen, N. J.

WILEY DISCUSSES LIGNIN USE IN REINFORCEMENT OF RUBBER

In a recent address before the Chemical Market Research Association in New York City, Dr. Paul R. Wiley, manager of the Polychemicals Division of the West Virginia Pulp and Paper Co., Charleston, S. C., delivered an interesting paper entitled "The Outlook for Lignin and Lignin Derivatives as Chemical Products of the Pulp and Paper Industry". Dr. Wiley pointed out that of the applications developed for whole lignin, the most promising for its tonnage potential is the reinforcement of rubber. When lignin is dissolved in rubber latex and coprecipitated with the rubber by the usual acid coagulation it serves as a reinforcing agent analagous to carbon black and the mineral pigments.

Rubber compounds reinforced with lignin offer an unusual combination of properties, Dr. Wiley said, which characterize lignin as a potentially valuable addition to the group of reinforcing materials available to the rubber industry. For example, lignin has a lower specific gravity than other pigments, resulting in lighter weights for a given volume of rubber. It has a lower opacifying power than the black pigments, permitting lighter colors without the sacrifice of strength, Dr. Wiley declared.

At high loadings, it yields an extremely tough compound possessing the unusual combination of high tensile and tear strengths, elongation and hardness. In other properties, lignin is sometimes inferior, Dr. Wiley stated, and sometimes superior to other reinforcing fillers.

Dr. Wiley stressed that lignin should be regarded not as a replacement for other pigments, but as an additional pigment which permits attaining a new combination of properties. Its low cost and high reinforcing ability make it especially attractive, he declared.

The speaker revealed that in order to promote this application of lignin, his company has just put into operation a small plant to produce tonnages of lignin-rubber coprecipitates, or masterbatches. In producing these coprecipitates adjacent to its lignin plant, the company brings in rubber latex by tank car. In the long run, he said, the logical place to produce these materials would be in the synthetic rubber plants, where shipment of latex with its high water content could be avoided. It would not be difficult to conduct these operations in existing rubber plants, he opined, since existing operations are quite similar.

Meanwhile, he stated, the company is producing lignin-rubber coprecipitates itself because it is believed that it is the best way to make available the continuing commercial quantities needed for extended large scale evaluations. Since rubber compounding is so complicated, the compounders themselves are in the best position to explore all possibilities for lignin-reinforced rubber, he observed.

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Goodrich Appoints Isenburg

Orville E. Isenburg

Orville E. Isenburg has been appointed general manager, Harmon Colors, of the B. F. Goodrich Chemical Co., Cleveland, Ohio. Mr. Isenburg will direct all operations of the company's color business from the main color pigment plant in Haledon, N. J. He joined Goodrich in 1941, after receiving a B.S. degree in chemistry from the University of Illinois. In 1942, he became a member of the sales staff and in 1944 was transferred to the Chemical Division, which later became B. F. Goodrich Chemical Co. Mr. Isenburg held various technical and sales posts before becoming field sales manager for plastics materials in 1949. Sent to Harvard for advanced management courses in 1951, he became international sales manager in 1952. In 1953, he was named sales manager for Harmon Colors. Mr. Isenburg is a member of the Society of Plastics Engineers, the Society of the Plastics Industry, the A.I.C.E. and Dry Color Manufacturers' Association.

Dedicates Louisiana Plant

American Cyanamid Co., New York, N. Y., recently dedicated its new Fortier plant near New Orleans, La., at ceremonies attended by state, local and Cyanamid officials. The new plant is Cyanamid's first venture into the production of industrial chemicals from natural gas. Construction of the Fortier plant was begun in the early summer of 1952. Production units currently in operation include sulfuric acid, oxygen and ammonium sulfate. The acetylene, hydrocyanic acid, ammonia and acrylonitrile units are expected to be activated shortly.

Foxboro Building Factory

Foxboro Co., Foxboro, Mass., expects to complete construction of its new 15,000 square-foot plant at Pittsburgh, Penna., by August 1. The new factory will double the company's present instrument assembly, service and repair facilities. The second of three Foxboro plants to be built this year, the Pittsburgh factory will be a split-level structure; offices and sales headquarters will occupy the lower level; and instrument and control valve assembly, servicing and warehousing will take up the second level.

CARBON BLACK PRODUCERS SEE DOUBLED DEMAND IN 20 YEARS

According to recent published reports, carbon black producers are envisioning a doubling of demand within the next 20 years in consideration of greater rubber consumption and increased use in plastics. In 1953, over 1,600,000,000 pounds of carbon black were produced by eight companies and their subsidiaries. This figure represents about one-third more than the industry turned out in 1945 and four times what was produced in 1941.

Production in 1954 may slacken somewhat, reflecting an expected dip in automobile and truck tire production. About 93% of all the carbon black produced goes into rubber products, and most of this amount is consumed in the manufacture of tires. One company official predicted that in five years carbon black output in the United States will be in excess of 2,000,000,000 pounds, and it could be substantially in excess of that.

In recent years, increasing quantities of carbon black have found their way into the production of plastics. Last year, consumption for this purpose was about 1,000,000 pounds. In the next two years, however, demand from this source is expected to amount to 6,000,000 pounds. This demand, carbon black manufacturers believe, will keep pace with the manufacture of plastics products, particularly polyethylene.

Hooker Personnel Changes

Hooker Electrochemical Co., Niagara Falls, N. Y., has announced that several changes in the organization of the company were made at the June 22 meeting of the board of directors in Tacoma, Wash. Hiram B. Young, formerly works manager of the Niagara Falls, Ashtabula, Ohio, and Montague, Mich., plants, has been elected vice-president in charge of eastern production. Thomas E. Moffitt, who was western manager of the Tacoma plant and other West Coast activities, has been elected vice-president in charge of western operations. F. Leonard Bryant, superintendent of the Niagara plant, is now works manager of this plant. The company recently played host to more than 200 persons visiting its newly-opened $12,000,000 caustic soda plant at Montague on June 18. Guided tours were conducted through the plant and also through the power station at Muskegon, Mich.

Clinch Named Ohio Representative

Rubber Corporation of America, N. Y., N. Y., has announced that its new sales representative for the state of Ohio will be Allan Clinch. Mr. Clinch will headquarter at 2076 Romig Road, Akron, and will handle the sale of RCA's line of plasticizers, latex compounds, plastisols and natural and synthetic lactices. Associated with RCA since 1950, Mr. Clinch did development work on plastisols and supplied technical assistance to customers. The company offices in Chicago will continue to cover the midwestern states, with the exception of Ohio. The company reports that as of early July, 1954, its executive offices will be located at New South Road, Hicksville, N. Y.

ASTM CRUDE RUBBER GROUP REPORTS ON RECENT MEETING

Subcommittee XII on Crude Natural Rubber of Committee D-11 on Rubber and Rubberlike Materials, American Society for Testing Materials, held an interesting meeting on February 4 at the Shoreham Hotel in Washington, D. C., in conjunction with a meeting of the parent group. The meeting was attended by 35 members and guests.

Norman Bekkedahl, chairman of the subcommittee, first introduced C. C. Miller, secretary of the Crude Rubber Committee of the Rubber Manufacturers Association, who described some of the work of the RMA committee. He referred to the "quality campaign" on natural rubber of RMA, and mentioned the "Rubber Quality Bulletins" being issued to record the progress of this campaign.

"Natural Rubber Buying", another publication of RMA, is a record of the Crude Rubber Quality Seminars conducted in 1952 by the association, and covers type samples, packing specifications, inspection techniques, methods of purchasing, etc. Mr. Miller explained that RMA was in favor of continuing the U. S. Department of Agriculture's Latin America research program on high-yielding, blight-resistant stock.

The chairman announced that the new liaison man between the RMA and ASTM Crude Rubber Committees is R. P. Stock, manager, raw materials inspection and development department, B. F. Goodrich Co., Akron, Ohio, who replaces C. O. Miserentino, Dunlop Tire and Rubber Corp., who recently resigned from that post.

Report on Chemical Analysis

A task group on trace metals in rubber submitted a report to Subcommittee XI on Chemical Analysis recommending adoption of a dry ashing procedure rather than wet oxidation of the sample for destruction of organic matter, and also the adoption of a photometric method of final solution analysis as a preference over the older visual method.

In connection with the method of determining harmful dirt in rubber (now official tentative procedures of the ASTM) the Rubber Research Institute of Malaya in a letter to the chairman of Subcommittee XII, objects to the use of the 325-mesh screen and suggests the 270-mesh screen. Malaya and England claim they have no 325-mesh screen and that under the present definition of harmful dirt, up to 7% of the powder on the surface of bales would be retained on the 325-mesh screen and give a false value for dirt actually in the rubber.

R. P. Stock, chairman of the task group on dirt, reported that his group unanimously recommends that the dirt content methods continue to use the 325-mesh screen. Reasons given for this action were as follows: (1) The use of the 325-mesh screen is standard practice in the United States, particularly for pigments for compounding, and is therefore the logical choice for dirt in rubber; (2) Recent RMA specifications for crude rubber bale coatings specify the use of the 325-mesh screen.

Also, (3) Many other countries recognize and use the 325-mesh screen, and it is available in London from International Combustion Co.; (4) Since the majority of countries concerned use the 325-mesh screen, its adoption by England to facilitate work of the International Standards Organization seems necessary; (5) ASTM Specification E-11-39, "Sieves for Testing Purposes," would have to be modified if the 325-mesh screen is eliminated by ISO.

Also, (6) The determination of the harmful effect of particles of various diameters in order to find out if a larger opening would be satisfactory would require an enormous amount of work. After this report and considerable discussion on the subject the subcommittee voted unanimously to retain the 325-mesh screen in the present tentative methods for harmful dirt in crude natural rubber.

Sampling Methods Task Group

A task group on sampling methods from Subcommittee XXVIII on Statistical Quality Control was represented by I. M. Cameron, National Bureau of Standards, who indicated a desire to know what were some of the factors involved from the rubber goods manufacturers viewpoint. He indicated a plan of attack on the problem including possible sources of bale-to-bale variability for each type of rubber, assembling existing data, listing of needed information, estimation of different variance components, study of test methods, and requirements of purchasers with respect to precision of average assigned to a shipment.

W. Fairfield Smith, University of North Carolina, a statistician with plantation experience in rubber, was introduced by Mr. Cameron. He emphasized the need for knowledge on the distribution of dirt in bales of rubber.

A task group to study the possibility of developing methods for determining the vulcanization behavior of rubber by means of the Mooney viscometer is to be established. This group is to work in cooperation with Subcommittee X on Physical Testing.

J. M. HUBER ANNOUNCES PROMOTION OF HARRIS, LIBBY AND GONGWER

G. W. Harris

P. W. Libby

L. F. Gongwer

J. M. Huber Corp., New York, N. Y., has announced the appointment of Gerald W. Harris, formerly in charge of eastern sales to the rubber industry, to assistant vice-president of the Industrial Products Department. Mr. Harris will supervise sales of carbon blacks, clays and rubber chemicals. Paul W. Libby, formerly supervisor of rubber sales in the middle and far west, has been named manager of the company's development laboratories at Borger, Texas. Mr. Libby will be in charge of technical service for rubber industry customers in the west. Louis F. Gongwer, previously supervisor of development laboratories at Borger, has been appointed divisional manager of sales to the rubber and general industries.

H. K. Porter Purchases Pioneer

H. K. Porter Co., Inc., Pittsburgh, Penna., has announced the acquisition of Pioneer Rubber Mills Inc., of Pittsburg, Calif. Pioneer Rubber will become part of the Quaker Rubber Corp., one of the H. K. Porter Co.'s nine divisions. The new acquisition is the fifteenth factory in the Porter group. Pioneer manufactures rubber belting, hose, packing and many other industrial rubber products similar to those manufactured by Quaker at its Philadelphia, Penna., factory. Sumner M. Suhr, sales manager, who has been with Pioneer since 1917, has been appointed manager of the new division, under George A. Dauphinais, vice-president and general manager of Quaker Rubber.

ASTM Awards of Merit

Technical leaders in the field of engineering materials—men who have rendered outstanding service to the American Society for Testing Materials, particularly in its technical work—were honored during the 57th Annual Meeting in Chicago the week of June 14 when they received awards of merit. Among the recipients of awards were: H. A. Anderson (Western Electric), O. M. Hayden (DuPont), and G. M. Kline (Bureau of Standards).

Ganchan Elected Vice-President

R. P. Ganchan

R. P. Ganchan, general manager of ARco Rubber Processors, Houston, Texas, a division of the Automotive Rubber Co., Inc., of Detroit, Mich., was recently elected a vice-president of the parent company. Mr. Ganchan is a native of Beaumont, Texas. He was graduated from Rice Institute in 1940 with an engineering degree. Following service during World War II, he served as a sales engineer with the Standard Brass and Manufacturing Co. of Houston. As a vice-president, Mr. Ganchan will now engage in top level direction of all ARco installations.

Announces Licensing Agreement

Bakelite Co., New York, N. Y., has announced an experimental licensing agreement with the Elastomer Chemical Corp., Newark, N. J., under the patents held by Elastomer for foaming vinyl resin plastisols. Mixtures of vinyl resins and plasticizer have many interesting properties applicable in the field of flexible foamed products similar to foamed rubber and appear to have many significant qualitative and economic advantages over foamed rubber products, Bakelite states. Bakelite has been licensed under the Elastomer Chemical patents for experimental purposes and is prepared to work cooperatively with all other licensees under those patents in the commercial application of Bakelite vinyl resins to this newly-developing field.

McChesney Named Chief Engineer

Dunlop Tire & Rubber Corp., has appointed C. S. McChesney chief engineer of its plant in Buffalo, N. Y. Mr. McChesney, acting chief engineer since last December, has been with Dunlop for the past 31 years, serving successively as draftsman, chief draftsman and, since 1928, superintendent of engineering. When the company developed the original latex foam process, Mr. McChesney supervised the design and construction of the specialized processing equipment, said to be the first of its type in the United States. Since joining the company, he has obtained 29 patents on equipment for the manufacture and processing of tires, latex foam, golf and tennis balls.

Thiokol Club Hears Ball

The Thiokol Technical Club at its meeting on June 9 at the headquarters of the Thiokol Chemical Corp. in Trenton, N. J., heard an address by John M. Ball of the Midwest Rubber Reclaiming Co. Mr. Ball spoke on rubber reclaiming operations at the East St. Louis, Ill., plant of the company and described the various processes being used to reclaim rubber. He reviewed briefly the history of the rubber reclaiming industry and went into some detail on the alkali digestion and mechanical separation methods. The processes of Midwest Rubber Reclaiming were described in an interesting manner by means of a color movie. Mr. Ball stated that the quality of reclaim had been considerably upgraded since World War II and that various types were available for specific purposes. One of the interesting aspects disclosed was the fact that the present tubeless tire cannot be reclaimed because of the contamination from the Butyl rubber. The speaker also discussed some of the advantages of powdered reclaim. Although the properties developed are similar to those of the sheet types, more accurate and versatile compounding is possible with the powder form, he declared. The talk and the movie were preceded by a social hour and a dinner.

Philippine Rubber Production

According to recent reports from the Philippines, the first of that country's basic industries to falter under post-Korea conditions and to lose out to foreign competition is plantation rubber. Five out of seven plantations in the islands have already shut down and the remaining two are soliciting government aid in order to survive. The planters are requesting a government waiver of the 7% sales tax currently collected on natural rubber. What is said to be a basic disadvantage to Philippine producers is a government regulation which requires planters to sell their product at home "at the equivalent of overseas market quotations", rather than at the price charged by importers of synthetics. Only rubber not absorbed domestically under these terms is eligible for export. Plantations already in existence can produce twice as much rubber annually as is consumed domestically.

Esso May Make Butyl in Britain

Oil and rubber interests have been discussing the possibility that the Esso refinery at Fawley, England, may be preparing to manufacture Butyl rubber. Esso officials admit this is a "serious possibility," but that no decision has been made. They point out that the American parent company may decide to produce this general-purpose synthetic rubber at Fawley, in France, or in Germany, where Esso recently opened a refinery at Hamburg. While the rubber industry would value a British source of general-purpose synthetic rubber, the British Colonial Office, interested in protecting natural rubber producers, seems to be strongly opposed. Elsewhere in Europe, particularly in France, there is no such duality of government interests.

Heads New Sales Division

Harold J. Klee

Harold J. Klee has been appointed manager of the newly-organized Central Sales Division of the Stauffer Chemical Co., with headquarters in Chicago. The Central Sales Division has district sales offices in Chicago and Houston, Texas. Mr. Klee was formerly manager of the Chicago sales district. J. H. Begley, formerly assistant manager of the Chicago sales district has been appointed manager succeeding Mr. Klee.

Reports on Flo-Mix Demand

Demand for "Flo-Mix" has so far exceeded expectations, according to C. H. Peterson, president of the U. S. Rubber Reclaiming Co., Buffalo, N. Y., that a substantial part of the facilities of the company's new plant are already employed in its manufacture. The new product, which is a powdered material and pours easily, was introduced last August. Plans for stepped-up production have already been made to meet the expected increase in demand from many firms now using the product only in experimental quantities. Selling for about 10% less than comparable grades of reclaim in slabs, Flo-Mix is adapted to bulk shipping either in tank cars or an exact weight in bags. Some users order the product packed in polyethylene bags so that the entire unit can be put in the Banbury mixer.

Hewitt-Robins Promotes Two

Two promotions within its International Division were recently announced by Hewitt-Robins Inc., Stamford, Conn. J. J. Murray has been appointed manager of foreign sales, with responsibility for the export marketing of products and services of domestic plants and foreign subsidiaries. J. J. Sheehan has been named manager of foreign operations. He will be responsible for general management policies and the activities of foreign subsidiaries and affiliates. The company has subsidiaries and affiliates in England, France, Canada, South Africa and Italy.

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C.I.C. RUBBER CHEMISTRY GROUP HOLDS NINTH ANNUAL MEETING

The Rubber Chemistry Division of the Chemical Institute of Canada held its Ninth Annual Meeting at the Royal York Hotel in Toronto, Ont., Canada, on Wednesday, June 23. The meeting featured the presentation of eight technical papers and the election of new officers. The divisional banquet was not held this year. Attendance at the technical sessions, held in the morning and afternoon, amounted to approximately 80 members and guests at each session. The eight papers presented, abstracts of which appeared in the June, 1954, issue of RUBBER AGE, were as follows:

"Promotors for the Reaction of Carbon Black with Rubber," by Kenneth W. Doak, George H. Ganzhorn, and Bernard C. Barton, U. S. Rubber Co., Passaic, N. J.

"Low Temperature Plasticizers", by M. A. Pollack, W. C. Hardesty Co., New Toronto, Ont., Canada.

"Kinetics and Cross-Linking Efficiency in Mercaptobenzothiazole Vulcanization", by Irving Auerbach, Goodyear Tire & Rubber Co., Akron, Ohio.

"Carboxylic Nitrile Rubber—A New High Strength Elastomer", by H. P. Brown and N. G. Duke, B. F. Goodrich Chemical Co., Cleveland, Ohio.

"Ozone Resistance of Butyl Vulcanizates", by D. C. Edwards and E. B. Storey, Polymer Corp., Sarnia, Ont., Canada.

"Carbon Blacks for the Rubber Industry", by Leslie D. Carver, Continental Carbon Co., New York, N. Y.

"Influence of Various Weathering Factors on Ozone Cracking of Natural and Synthetic Rubbers", by W. G. Mayes, Chemical and Physical Research Laboratories, Firestone Tire & Rubber Co., Akron, Ohio.

"Statistics—A Tool in Testing Rubber", by Robert D. Stiehler, National Bureau of Standards, Washington, D. C.

G. D. Stevens (Canadian Goodyear), chairman of the Division, presided at the morning session, while Harold Loiselle acted as chairman for the afternoon session.

New Officers for 1954-55

The business meeting of the Division was held at the end of the first technical session, with Mr. Stevens presiding. A new slate of officers was elected for the 1954-55 season, as follows:

Chairman, F. R. Gorrie (Cabot Carbon of Canada); *Vice-Chairman*, G. J. Baxter (Firestone); *Secretary-Treasurer*, O. R. Huggenberger (Dominion Rubber). The following members were elected to the Executive Committee: H. K. Cunliffe (Dominion Rubber), J. Carr (Dunlop Tire), W. Gedye (Monsanto-Canada), and E. J. Gibson (Canadian Industries—1954).

E. Ralph Rowzee, vice-president and manager of the Polymer Corp., Ltd., Sarnia, Ont., Canada, was elected president of the Chemical Institute of Canada. Mr. Rowzee, who was associated with the Goodyear Tire & Rubber Co. from 1935 to 1944, holds a master's degree in chemical engineering from M.I.T.

In addition to the other activities, several awards were made at the meeting. George Stafford Whitby, professor emeritus and director of rubber research at the University of Akron, was awarded an Honorary Fellowship in the C.I.C. This honor was granted in recognition of his significant contributions to Canadian chemistry.

Dr. R. K. Stratford, advisor to Imperial Oil, Ltd., and president of the Research Council of Ontario, won the Chemical Institute of Canada Medal for 1954. This medal is awarded annually by the Institute for outstanding contributions to Canadian chemistry and chemical engineering.

The Rubber Manufacturers Association has just published the 1954 edition of its display chart containing correct tire inflation pressures for passenger cars.

R. P. DINSMORE CELEBRATES 40TH ANNIVERSARY WITH GOODYEAR

Dr. R. P. Dinsmore, vice-president in charge of research and development for the Goodyear Tire & Rubber Co., was honored in special ceremonies on July 6 in Akron, Ohio, in commemoration of his 40th anniversary with the company. Winner of the Colwyn Gold Medal in 1947, Dr. Dinsmore was presented with a long-term service pin by P. W. Litchfield, chairman of the board. More than 1,200 of Dr. Dinsmore's associates witnessed the presentation in the Goodyear Theater on the afternoon of July 6.

At the presentation ceremonies, M. L. Hyde, vice-president of the company, introduced E. J. Thomas, president, and R. S. Wilson, vice-president in charge of sales. Both Mr. Thomas and Mr. Wilson paid tribute to Dr. Dinsmore's accomplishments throughout the years. They pointed up their remarks by relating many personal experiences and incidents which gave new insight into the character and personality of the guest of honor.

Following the ceremonies at the Goodyear Theater, there was a special cocktail party followed by a dinner at the Mayflower Hotel. More than 300 persons were on hand to pay tribute to Dr. Dinsmore and to hear him described as the person who had done more "to assure the success of the synthetic rubber program than any other man." At the dinner, A. J. Gracia, general manager of the Goodyear Atomic Corp., presented a gift to Dr. Dinsmore from his associates.

The principal speaker at the dinner, for which Mr. Thomas acted as master of ceremonies, was Dr. Webster N. Jones, vice-president in charge of industrial and government relations for the Carnegie Institute of Technology, and a long-time associate and personal friend of Dr. Dinsmore. Dr. Jones pointed out that Dr. Dinsmore "has sparked the development of improved compounding ingredients, accelerators and age resistors."

He also spoke of many of the developments which originated with Dr. Dinsmore, and stated that what he had accomplished indicates intelligence, foresight, and the unusual ability to select, train, direct and inspire men.

Dr. R. P. Dinsmore

Dr. Dinsmore, a graduate of the Massachusetts Institute of Technology, was born in Tewksbury, Mass. He joined Goodyear in 1914 to work on technical service and compounding in Akron. During his career with the company he also served in Los Angeles and in Canada. Dr. Dinsmore was appointed to his present post in 1943.

During World War II, Dr. Dinsmore served as assistant deputy rubber director. He organized and directed research and development work on synthetic rubber for the government, and coordinated the activities of both industrial and university laboratories. Recently, he was named president-elect of the American Institute of Chemists, and in May, 1956, automatically becomes president of that organization for a two-year term.

Dry-Film Coatings Available

Acheson Colloids Co., Port Huron, Mich., has announced the availability of two new "dag" dispersions for industry: "dag Dispersion No. 213," containing colloidal graphite, and "dag Dispersion No. 223," containing colloidal molybdenum disulfide. These two products offer the advantages of the new epoxy resins as a base for dry, lubricating coatings. Films formed with these dispersions are said to display excellent adhesion and wear-resistance. They are unaffected by oils and solvents, and can be used wherever temperatures do not go above 500°F. All types of surfaces, whether or not they have been pretreated by chemical or mechanical means, can be coated.

SYMPOSIUM ON PLASTICS IN RUBBER INDUSTRY FEATURES SPI CONFERENCE

A symposium on "Plastics—New Materials in the Rubber Industry" was a feature of the 1954 Annual Plastics Conference, sponsored by the Society of the Plastics Industry, which was held in conjunction with the Sixth National Plastics Exposition from June 7 to 10 at the Hotels Cleveland and Statler in Cleveland, Ohio. Frank W. Steere, Jr., president of Steere Enterprises, Inc., presided at the symposium, while Donald F. Siddall, director of research of the U. S. Stoneware Co., served as moderator.

In an introductory statement, Mr. Siddall observed that from the year 1940, up to the present, no one has escaped the impact that the growth of plastics has created, whether it be surveyed from an industrial, domestic or military viewpoint. This fact, stated Mr. Siddall, begs the question as to how this came about, who shares in the responsibilities of such growth and where, if any, are the limits of growth for the future. We can point, he said, to several landmarks to serve in part as a logical explanation.

World War II planted the seed by strict necessity, to devise, develop and produce synthetic base materials to supplant or augment critical materials such as rubber and metals. The successful culmination of the war, it is agreed, was assisted in no small way by the ingeniousness of the chemical industry, its management, its executives, technical personnel and labor forces. These materials, born and fostered under circumstances where years must, of necessity, be compressed into weeks, were due for many changes. Plastics, however, were thrust into every phase of our daily life, carrying a birthmark that was necessary, yet unfortunate. They are all too often viewed as a substitute, a replacement or ersatz material, Mr. Siddall stated.

Period After World War II

The period following World War II focussed attention on the embryonic chemical industry. By sound reasoning, they envisioned better materials, better products by first upgrading the old, developing the new and above all, directing their attention to plastics. Plastics are considered not as substitutes but as materials of construction that have reached and surpassed a point of maturity wherein they offer new ideas, cheaper and better products, and merit in their own right a distinct and separate position along with rubber, metal, glass, ceramics, textiles, wood and other basic building blocks.

With chaotic beginnings such as these, it was difficult to avoid mistakes. Errors were compounded by small and large companies in the scurry for position in this new attractive field and the net result was that the consumer, having no other yardstick with which to measure other than "performance by comparison", was reluctant to condone all intentional or unintentional errors in judgment.

Fortunately, the industry as a whole, and acting in unison, is progressing toward that goal that protects the very name of plastics by a self-imposed creed. Enrolling the cooperation of all phases of the industry will not fail to impress the consumer that the plastics of today are fully accredited and prophetic of new and better materials for tomorrow.

"As we are about to open a discussion on plastics, I think it is agreed that the subject matter is to be considered as a basic raw material, having many and varied possibilities in its own right and will, I am sure, stimulate new ideas, new combinations and new processes as well as interchange some opinions and facts relative to mutual problems of today," Mr. Siddall declared.

At the symposium, Frank A. Martin of the Hoover Co., North Canton, Ohio, presented a paper on "Flexible Materials—Extrusion and Molding Developments". The speaker stated that flexible plastics, by definition, include plasticized polyvinyl chloride and its copolymers, and polyethylene. These materials and particularly the PVC formulations are of interest to the rubber industry because they are competitive in many end-uses.

Compounding PVC Resin

PVC resin must be compounded with plasticizers, stabilizers, fillers, lubricants, and colors in order to form a useful flexible material. If sufficient heat is added to flux the resin, the compound must be pelletized before subsequent processes. If, however, the compound is processed with only sufficient heat to cause the resin to absorb the liquids without fluxing, the resultant compound is a dry, free-flowing powder. Molding and extrusion of PVC dry blends is rapidly becoming a popular means of processing PVC, Mr. Martin declared.

Both granules and dry blends can be molded on conventional injection machines, but certain principles must be observed. The basic problem is that of getting sufficient heat into the compound to render it moldable without overheating to the point where decomposition sets in. For molding dry blends, a drilled sleeve type of spreader, together with a strainer plate in the nozzle is generally helpful, and somewhat higher temperatures are required than for granular compounds. A screw pre-plasticizing type of machine has been found to give excellent results on both dry blends and granules.

The art of extrusion of PVC is much more advanced than is the molding. Extruders handle either dry blend or granules with much the same success. A higher compression ratio screw seems more desirable for powder than for granules, and temperatures may again be somewhat higher. Water cooling of the screw in either case is necessary. Typical applications are garden hose, film, gaskets, wire coating, and a wide variety of tubings.

Polyethylene molding has remained largely in the hands of purely plastics processors. It is easily molded on conventional injection machines, since it is readily heated without decomposition. Perhaps the biggest problem is control of mold shrinkage, through control of material and mold temperatures, and of injection pressures. Successful applications are in housewares, blown squeeze bottles, and some industrial parts.

The extrusion of polyethylene again is quite straightforward, with three types of goods accounting for the largest volume of material. Polyethylene pipe has been widely used for carrying corrosive liquids, for jet well installations, and for irrigation tubing. The good electrical properties have won a place for polyethylene in the wire and cable industry for such things as TV lead-in wire, and submarine cable jackets. Blown film is prominent in the packaging field because of its good moisture barrier and heat-sealing properties. With ample supplies of polyethylene now in sight, undoubtedly many new applications, both molding and extrusion, will be made, Mr. Martin concluded.

In his paper on "Plastisols—Processing and Applications", Robert P. Molitor of the Sun Rubber Co., Barberton, Ohio, stated that the basic steps in processing vinyl plastisols are relatively simple. He then offered a review of some of the principles involved. He also discussed the major methods of manufacturing plastisol items, including the rotational casting of hollow objects, slush casting, low pressure casting, dipping, and coated fabrics.

Mr. Molitor stated that the greatest contribution to the fullest use of plastisols and what he considers as the number one and number two project for all vinyl chemists is to devise some means of "vulcanizing" vinyls and to improve upon hardness limitations. Such a development will permit the combining of vinyls' superior physical and processing properties with the curing advantages of rubber and those hardness advantages of thermosetting plastics.

By doing this, he stated, it will no longer be necessary to include the expensive and time consuming cooling step. Vinyl items will then be able to be stripped hot from molds, forms, etc. Processing will then be much simpler and faster, and product application can be greatly enlarged.

"Vinyl Sponge and Foam—Processing and Applications" was the title of the paper presented by George R. Sprague of the Sponge Rubber Products Co., Shelton, Conn. Mr. Sprague stated that vinyl sponge and foam are generally considered to be an expanded thermoplastic resin of the polyvinyl chloride and related copolymer family. The vinyl resin is usually the plastisol or stir-in type.

Types of Expanded Vinyl

There are two types of expanded vinyl, namely an open celled sponge or foam and a closed, unicellular material. The words "sponge" or "foam" as a carry-over from rubber terminology, generally imply an interconnecting cell structure which allows the free passage of air through the article. A non-interconnecting or unicellular structure is frequently referred to as "Cell-Tite". Both, said the speaker, have many individual properties which regulate their end uses, though both are made from the same raw materials.

From this point on, Mr. Sprague limited his discussion to open-cell vinyl foam or sponge. He outlined the two basic processes for the manufacture of vinyl foam. It was

noted that many of the most promising applications of vinyl foam may be realized when the foam is combined with a solid vinyl skin. This skin may be embossed or plain and may be calendered sheeting or slush moldings.

Prominent uses for this combination article are in the upholstery and automotive fields. Cushions, armrest trim sections, crash padding, etc., are both very decorative and durable. Other articles of vinyl foam are: toys, transfer printing rolls, rug underlay, display sheeting, miscellaneous molded and die-cut gaskets. Mr. Sprague concluded by stating that as industry has come to realize the tremendous potentialities of solid vinyl, so it will also create a fine future market for expanded vinyl foam.

George S. Laaff of Bolta Products, a division of the General Tire & Rubber Co. at Lawrence, Mass., for his part in the symposium, presented a paper on "Rigid Vinyls and Rubber-Resin Blends — Processing and Applications". Mr. Laaff observed that the acceptance of polyvinyl chloride, as a chemically-resistant structural material, has steadily broadened in the United States. PVC has superb chemical resistance, but the basic impact strength is lower than requirements often demand. Industry needed a tougher material even if chemical resistance was lowered slightly. The improvement has been made, much as the same improvement was made in styrene years ago, by the addition of rubber modifiers either by direct addition of premasticated Buna N rubber to fluxed vinyl in a Banbury mixer or by the co-precipitation of blended latices.

Rubber-Modified PVC

In processing rubber-modified PVC, the same precautions should be used that are used with unmodified polyvinyl chloride. Time and temperature conditions must be carefully controlled during the Banbury mixing, milling, calendering or extrusion operations. Magnificent progress has been made in equipment and in the development of equipment to control these variables. Polymer chemists have contributed much to uniformity of resin characteristics by detailed study of molecular structure and their rheologic properties, Mr. Laaff stated.

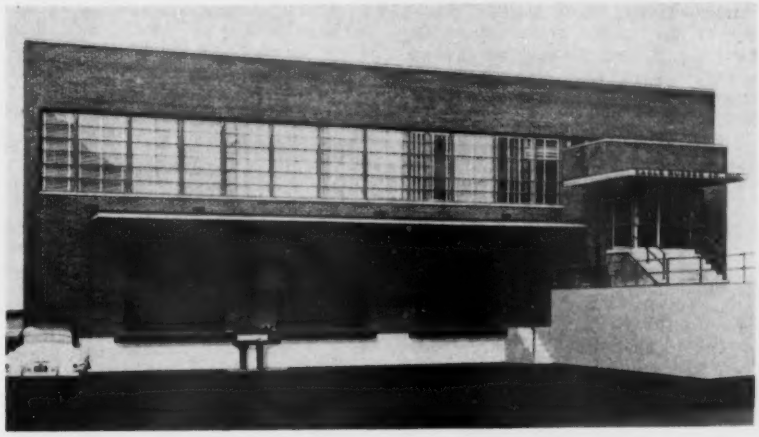
The fabrication of rubber-modified PVC is only slightly more difficult than the fabrication of unplasticized PVC. It is easily hot gas welded, but at a temperature of, perhaps, 20°F., higher than that used for straight polyvinyl chloride; however, the modifying rubber seems to cause a slight reduction in the weld strength. The development of impact strength at the weld has not yet been accomplished because of the aforementioned fact.

Molding is accomplished in the same equipment used with UPVC. The plug and ring, vacuum or blow molding processes are applicable with little or no change in operation. Machining precautions are the same as applied to unmodified polyvinyl chloride with, perhaps, a little less attention given to notch weakness.

The modified material will not take the place of unplasticized PVC. The purpose is to supplement UPVC with a tough material having as high chemical resistance as possible, Mr. Laaff concluded.

The Exposition featured a record number of exhibitors, 172, who used over an acre and a quarter of Cleveland's Public Auditorium to show their latest plastics developments to an estimated 18,000 visitors. These companies, representing every facet of the industry, exhibited new plastics products, machinery, processing equipment and basic materials for the edification of representatives of business, industry, retailing and government from all sections of the U.S. and Canada, Europe, South America and from Australia and Asia.

EAGLE RUBBER ANNOUNCES CONSTRUCTION OF NEW FACILITIES AT ASHLAND



Eagle Rubber Co., Ashland, Ohio, in another step in an expansion program that began in 1952, has moved into its new $250,000 building in Ashland. The new facilities house the company's executive offices, a new plastics manufacturing division, and provide larger shipping and warehousing space. The modernistic, two-story building adds approximately 26,000 square feet of space to the Eagle Rubber plant. Complete fireproof steel, concrete and gypsum construction was used throughout, with a sprinkler system to give further fire protection. The entire first floor of the new structure is devoted to shipping and finished stock storage, allowing the company to maintain an adequate packed stock inventory. Improved shipping facilities have also been added including a greater area for assembling and packing as well as larger loading docks, the company revealed.

Constructing Laboratory Building

Enjay Co., Inc., has announced plans to construct a new building at Linden, N. J., to house its newly-created Enjay Laboratories Division. The new building will be erected on the grounds of the Research Center of the Standard Oil Development Co., and will contain eleven laboratories and fourteen offices. The new division will supply sales technical service in the chemical products field for Enjay. Construction, already under way, is scheduled to be completed by November 1, 1954, on the 54-foot wide, 230-foot long brick and cement structure. O. V. Tracy, Enjay president, said the modern installation is designed to provide the latest equipment for experimentation to petroleum solvents, additives, chemicals, and polymers marketed nationally by Enjay. A primary purpose of the laboratories is to study the individual needs of Enjay's customers, he added. Dr. Miller W. Swaney, formerly assistant director of Standard Oil Development's Chemical Division, was recently appointed director of the new Division.

ASTM Standards Supplements

The American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Penna., has announced the "1953 Supplements to Book of ASTM Standards". Published in seven complete parts, Part 6 concerns itself with Rubber, Plastics and Electrical Insulation. This part has 208 pages and includes 28 standards covering rubber products (processibility tests; physical tests of vulcanized rubber; aging tests; automotive and aeronautical; latex foam, sponge and expanded cellular rubber; rubber adhesives; crude rubber, and packing materials). Also covered are plastics (thermal properties; analytical methods, and conditioning), and electrical insulating materials (mineral oils for electrical insulation; insulating fabrics and paper; mica products, and conditioning). The 1953 Supplements can be obtained from ASTM at $3.50 per part, or $24.50 for the complete set of seven parts.

Acquires Merrill Laboratories

Arthur D. Little, Inc., Cambridge, Mass., has acquired the Research and Development Division and laboratories of the Merrill Co., a well-known metallurgy and engineering firm in San Francisco, Calif. The Merrill laboratories will now be known as the Western Laboratories Division of Arthur D. Little, Inc., and will immediately make research and product development by the parent company available to West Coast industry. Charles G. Harford, associated with ADL since 1925, will be technical director of the new division. R. E. Byler, who has been responsible for technical activities of the Merrill Co., has been named business manager.

RUBBER GROUPS ABOUT THE COUNTRY HOLD GALA SUMMER OUTINGS

With the coming of the summer months many of the rubber groups about the country forego their usual technical meetings to hold picnics, golf tournaments and outings. These affairs usually feature different athletic contests, while those less athletically inclined play cards, snooze under a shady tree, or just sit and talk with the boys. Reports on the activities of some of these groups at their annual outings follow:

BOSTON RUBBER GROUP

The Eighteenth Annual Outing of the Boston Rubber Group was held on June 18 at the Andover Country Club, Andover, Mass. Approximately 540 members and guests attended. The outing featured a full schedule of athletic activities and the serving of a special dinner. Arthur Ross (American Biltrite) served as chairman of the Outing Committee with David Kirkpatrick (Boston Woven Hose) and Harry Atwater (Malrex Chemical) serving on the committee. L. Longworth headed the golf tournament, while E. F. Freeman was in charge of the softball game. J. Fitzgerald ran the putting contest and L. Murray and A. Panzeri took charge of the darts contest. The horseshoes game was run by J. Cullen, while L. Westcott was in charge of the tub and ball game. The horse racing game was run by C. Meyer.

The soft ball game was won by a team representing Godfrey L. Cabot, Inc. P. E. Blanchard and E. Webber took first place in the horseshoes game, while C. Wilson and Mr. Nevis took second place. The darts game was won by A. Pierous with R. Clark in second place. T. Panzeri came in first in the tub and ball game with H. Saforn in second place.

In the golf tournament, William Able scored high gross and J. Cancelliere scored high net. The first three places in low gross went to J. Simpson, J. A. Loring and A. Nelson. The first five places in low net went to R. S. Ellis, P. L. Blanchard, R. Robin, F. Salamon and R. Cummings. S. Zulick took first place in the nearest-to-pin contest, while C. K. Mullins came in second. The putting contest was won by J. Hussey in first place with J. Clancy, L. Miller and J. Loring finishing in that order. A. L. Lukens scored the most 7's, and T. Murphy the most 8's.

First place in the kicker's handicap went to S. J. Bryant. Other winners of this event in order of finish included: S. J. Bryant, Mr. Nippers, A. B. Secor, G. Bushway, A. Sheery, L. C. Brook, H. Der, W. Stanton, and L. Longworth.

FORT WAYNE GROUP

The Fort Wayne Rubber and Plastics Group held its Third Annual Golf Outing at the Tippecanoe Lake Country Club, Leesburg, Ind., on June 11, 1954. Approximately 170 members and guests attended and participated in the days activities which included a lobster and roast beef dinner. In addition, many valuable door prizes were distributed. Elmo Niccum (Goshen Rubber) served as chairman of the Outing Committee, with J. Lantz (Goshen Rubber) as vice-chairman. Committee members included John Lawless (DuPont), Walter Wilson (R. T. Vanderbilt), Roger Hickernell (Monroe Auto Equipment), Sam Armato (Witco Chemical), Harry J. Baker (U. S. Rubber), and Robert Kahn (Goodyear).

First low gross was won by Wayne Place (Jasper Rubber) with a score of 73. Mr. Place received the golf trophy presented by Goshen Rubber and one presented by Jasper Rubber. Other golf prizes were awarded to Francis Frost (Frost Rubber) for second low gross; Milton Leonard (Binney & Smith), third low gross, and Al Laurence (Phillips Chemical), fourth low gross. Paul Lantz (Syracuse Rubber Products) received a prize for the longest drive.

Under the Calloway System, first group, Class A, prizes were awarded to Paul Elliott (Indoil Chemical), Vaughn Castor (Brown Rubber), D. Lamb and R. Kurtz (DuPont), Ferd Nanherney (Godfrey L. Cabot), C. Dietrick (Syracuse Rubber Products), R. Covington (American Zinc Sales), R. Schacht (Schacht Rubber), and M. Luedtke and M. Keyser (Rohm & Haas).

Second group, Class B prizes were awarded to James Dunne (C. P. Hall), Al Robinson (Harwick Standard), John Lawless (DuPont), E. Bosworth (Binney & Smith), J. Ledden (DuPont), H. Ling (Naugatuck Chemical), and Jack Carlson (Paranite Wire).

Third group, Class C prizes were awarded to F. Hoover (Sharples Chemicals), D. Moore and J. Stiff (Binney & Smith), H. Rapp (Belden Mfg.), and J. Brown (Jones-Dabney). The "booby prize" was awarded to K. Bunce (Monroe Auto Equipment).

NEW YORK RUBBER GROUP

Approximately 170 members and guests attended the Annual Summer Outing held by the New York Rubber Group on June 10 at Doerr's Grove, Milburn, N. J. Henry J. Peters (Bell Laboratories) served as chairman of the Outing Committee. The following members served as chairmen of the indicated events: *Golf Drive*, Leonard Komar (Titanium Pigment); *Basketball Throw*, M. E. Doane (H. V. Hardman); *Boccie*, R. B. Carroll (R. E. Carroll); *Horseshoes*, W. F. Lamela (Okonite); *Baseball Throw*, R. H. Barton (DuPont); *Darts*, R. C. Toth (India Rubber World); *Tug-of-War*, A. H. Woodward (DuPont), and *Baseball*, Ralph Graff (DuPont). The winners of various games and events included the following:

Golf Drive, Paul Hartsfield (DuPont); *Basketball Throw*, M. R. Buffington (Lea Fabrics); *Boccie*, R. K. Opper and W. B. Curtis (Naugatuck Chemical); *Horseshoes*, W. F. Lamela (Okonite) and K. E. Chester (C. P. Hall); *Baseball Throw*, K. E. Chester; *Darts*, Gordon Voigt (Niagara Rubber) and W. F. Fischer (Standard Oil Development).

The tug-of-war contest was won by the "Manhattan" team captained by Andy Rusin (Raybestos-Manhattan). The baseball game was won by the "Ramblers" captained by Ralph Graff (DuPont).

SOUTHERN OHIO GROUP

The Southern Ohio Rubber Group held its Annual Summer outing on June 5 at the Inland Activities Centre, Dayton, Ohio, with a golf tournament held at the Miami Shores Golf Club, Troy, Ohio. Herman F. Wening served as general chairman of the Picnic Committee, and committee members included: J. Ginn, D. Buchanan, B. Nolan, H. Schweller, R. Hempelman, R. Jacobs, F. Hovey, J. Wall, H. Butler, J. Feldman, T. Dillard, G. Harold, H. Karch, H. Weese, R. Hoskin, R. Kraus, F. Newton, J. Bohanan and J. Walsh. Other than the golf tournament, the outing consisted of a full schedule of games and sporting events and the serving of liquid and solid refreshments.

Approximately 55 members and guests participated in the golf tournament. The different events and the winners, follow: *Low Net for Blind Bogey*, Howard Butler, H. Bush and Harold Boose (Inland Mfg.); *Low Net for 69*, Tom Mattingly (Inland Mfg.), Bert Stangor (DuPont), Jim Wall (Inland Mfg.) and C. L. Zimmerman (C. L. Zimmerman Co.); *Low Net for 70*, James Haren (Precision Rubber Products), and Clete Moorman, Joe Bohanan and Frank Hovey (Inland Mfg.); *Low Gross*, Jim Wall, Bob Sucher (Witco) and Lou Keyes (Dayton Rubber); *High Gross*, James Hoerbelt (Dayton Rubber).

In other events, J. G. McCloskey (Inland Mfg.) won the foot golf contest. Paul Ludy (Thresher Varnish) and Frank Newton (Dayton Rubber) won the horseshoe game. Chuck Wimmer (Phillips Chemical) and Don Strack (Inland Mfg.) won the shuffleboard contest. The basketball contest was won by Frank Newton (Dayton Rubber) and Joe Holmes (Schenectady Varnish).

Wire-Insert Conveyor Belt

Ribbons of high tensile steel wire, inserted at intervals up to 3 feet, feature a new type of conveyor belt developed by the B. F. Goodrich Co. Industrial Products Division. The new belt is designed to prevent accidental rips from running the entire length of the belt when, under severe service, the belt is penetrated by sharp objects. The wire ribbons are positioned beneath the first fabric or cord ply and placed across the width of the belt. Used in conjunction with a Goodrich patented transcord breaker or longitudinal nylon cord breaker, the new construction is said to increase belt life up to 50%. While the company developed its first wire-insert belt for use in foundry shake-out service, the new construction is available in a variety of belts, including all types of hot material conveyor belts. The company reports that its new design greatly reduces maintenance and replacement costs of foundry belts carrying rough, sharp castings.

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WASHINGTON ELECTS OFFICERS; HEARS ADDRESS ON SILASTIC

Approximately 65 members and guests of the Washington Rubber Group attended the meeting held on May 19 in the auditorium of the Potomac Electric Power Co. Building in Washington, D. C. The meeting featured an election of officers for the 1955 season and an address by George M. Konkle of the Dow Corning Corp., Midland, Mich. Mr. Konkle spoke on the general subject of "Silastic", Dow Corning's silicone rubber. The following members were elected to office:

President, Paul Greer (Office of Synthetic Rubber); *Vice-President*, W. James Sears (RMA); *Secretary*, William Dunkle (Goodyear); *Treasurer*, Ethel Levene (Bureau of Ships). Rachel Fanning (American Dental Association-NBS) was elected to the post of recording secretary.

In his address, Mr. Konkle stated that recent developments in silicone rubber have produced stocks which have greatly reduced shrinkage from mold size to finished part. These materials have also low compression without the use of a toxic additive. Other materials have been developed that are self-extinguishing when the kindling flame is removed. These are presently available as pastes which can be dispersed in solvent for cloth coating.

Mr. Konkle stated that a Silastic paste is now available for the encapsulation of electrical components. This is a low consistency material which will flow at 100% solids. It can be set up by heat to form a resilient void-free jacket with good heat stability.

A number of different types of Silastic can be vulcanized in thick sections in hot air without the use of pressures, the speaker declared. This means that intricate extrusions can be vulcanized continuously. The technique is adaptable to standard extrusion machines. Mr. Konkle also stated that a series of recently developed pastes are available as two component systems which on combination will vulcanize at room temperature. This is an answer to the many applications for silicone rubber where heat cannot be applied to vulcanize the rubber.

Graham and Reich Appointed

Robert N. Graham and William F. Reich, Jr., have been appointed executive vice-presidents of the Carbide and Carbon Chemicals Co., New York, N. Y. Mr. Graham and Mr. Reich have been, respectively, vice-presidents in charge of production and of sales. Mr. Graham started with Carbide in 1922 as a research chemist. He was transferred to the South Charleston, West Va., plant and in 1935 he became plant superintendent. In 1940, he was transferred to New York as assistant works manager and in 1944 became vice-president for operations. Mr. Reich joined Union Carbide in 1919 as a sales correspondent for Linde Air Products Co. He served as sales representative for Linde and as a district manager in Buffalo and San Francisco, before being transferred to Carbide as manager of gas sales. In 1932, he became general sales manager for Carbide and was named vice-president in 1944.

Coming Events in the Rubber Industry

July 23. Chicago Rubber Group, Annual Golf Outing, St. Andrews Country Club, West Chicago, Ill.

Aug. 3. New York Rubber Group, Golf Tournament, Baltusrol Golf Club, Springfield, N. J.

Aug. 20. Philadelphia Rubber Group, Cedarbrook Country Club, Mount Airy, Philadelphia, Penna.

Sept. 15-17. Rubber Division, A.C.S., Fall Meeting, Hotel Commodore, New York, N. Y.

Sept. 16-20. Scrap Rubber & Plastics Institute, National Association of Waste Material Dealers, Inc., Sagamore Hotel, Bolton Landing, N. Y.

Sept. 23. Southern Ohio Rubber Group, Fall Technical Meeting.

Sept. 25. Connecticut Rubber Group, Annual Outing, Grassy Hill Park, Sodom Lane, Derby, Conn.

Sept. 30. Fort Wayne Rubber & Plastics Group, Hotel Van Orman, Fort Wayne, Ind.

Oct. 5. Buffalo Rubber Group, Westbrook Hotel, Buffalo, N. Y.

Oct. 5. Los Angeles Rubber Group, Statler Hotel, Los Angeles, Calif.

Oct. 8. Detroit Rubber & Plastics Group, Detroit-Leland Hotel, Detroit, Mich.

Oct. 15. Boston Rubber Group, Fall Meeting, Hotel Somerset, Boston, Mass.

Oct. 22. New York Rubber Group, Fall Meeting, Henry Hudson Hotel, New York, N. Y.

Nov. 3. Los Angeles Rubber Group, Statler Hotel, Los Angeles, Calif.

Nov. 12. Philadelphia Rubber Group, Dinner Meeting, Poor Richard Club, Philadelphia, Penna.

Nov. 18. Rhode Island Rubber Club, Fall Meeting.

Dec. 3. Los Angeles Rubber Group, Xmas Party, Ambassador Hotel, Los Angeles, Calif.

Dec. 8. Buffalo Rubber Group, Xmas Party, Buffalo Trap and Field Club, Williamsville, N. Y.

Dec. 10. Boston Rubber Group, Xmas Party, Hotel Somerset, Boston, Mass.

Dec. 10. Detroit Rubber & Plastics Group, Xmas Party, Sheraton Cadillac Hotel, Detroit, Mich.

Dec. 10. New York Rubber Group, Xmas Party, Henry Hudson Hotel, New York, N. Y.

Dec. 18. Southern Ohio Rubber Group, Xmas Party.

Skowbo Elected Treasurer

Stuart W. Skowbo has been elected treasurer of the Brown Co., Boston, Mass., effective June 1, 1954, according to a recent announcement by the company. A graduate of the University of Iowa with a master's degree in industrial management, Mr. Skowbo was employed in the Financial and Cost Divisions of the General Electric Co. for 15 years. He also served as vice-president and controller of the Cellerator Co., of Duluth, Minn., and most recently was controller and chief financial officer of Marshall-Wells Co., also of Duluth.

Union Bay State Names Thurman

George W. Thurman has been appointed to the Industrial Division of the Union Bay State Chemical Co., Inc., of Cambridge, Mass., as a technical sales representative for the Chicago area. Mr. Thurman will serve as consultant and sales representative for Wisconsin, northern Illinois, northern Indiana and northern Michigan. His office is at 9222 South Laflin Street, Chicago, Ill.

DuPont Technical Literature

The Rubber Chemicals Division of E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del., has released three new reports in its series of technical publications. BL-251 concerns itself with "Solution Coatings of Hypalon Chlorosulfonated Polyethylene"; BL-252 has to do with "The Role of Antioxidants in Improving Neoprene's Resistance to Ozone and Corona Cutting", while BL-253 is about "Unicel ND Blown Elastomer Sponge—Elimination of Odor". Copies of all three reports are available from the company.

Blue Pigment Trust Charged

The Department of Justice filed a civil anti-trust suit against the Standard Ultra Marine and Color Co of Huntington, West Va., and the American Cyanamid Co. of New York, N. Y., on June 29 in Washington, D. C. The two companies were accused of conspiring with two foreign concerns in connection with the manufacture and sales of ultramarine blue, a paint pigment, as well as laundry blue.

NAUGATUCK CHEMICAL DIVISION OBSERVING FIFTIETH ANNIVERSARY

The 50th Anniversary of the Naugatuck Chemical Division of the U. S. Rubber Co. was marked at a special press luncheon at the Metropolitan Club in New York City on May 19 at which John Caskey, vice-president and general manager stated that the division is growing at a faster pace than at any time in its history. With new production facilities soon to be completed and a number of new products scheduled to move from laboratories into production, there is a good chance that Naugatuck Chemical will increase its sales volume by 25% by 1956, Mr. Caskey declared.

Naugatuck Chemical, he said, is now responsible for production valued at more than $100,000,000 each year. This is 125% larger than 1946, 250% larger than 1940 and 500% larger than 1935, he added. Products presently produced by the division include rubber chemicals, synthetic rubber, agricultural chemicals, rubber latex, plastics, and TNT.

Nitrile Rubber Expansion

The current expansion, he stated, will add about 50,000,000 pounds of nitrile rubber, plastics and agricultural chemical production to the division's annual capacity before the end of 1954. It will bring its total yearly production capacity to more than 600,000,000 pounds of chemical products.

The division is currently doubling production of Marvinol vinyl resins in its Painesville, Ohio plant; tripling Kralastic molding powder production in its Baton Rouge, La., plant; constructing additional agricultural chemical production facilities in its Naugatuck, Conn., plant and expanding its latex plant situated in Los Angeles, Calif.

The division, said Mr. Caskey, has sixteen new products that will move from the laboratory into production this year. This is approximately one-third more than the number developed last year and it includes new vinyl plastics, new reclaimed rubbers, latex compounds, polyester resins, agricultural chemicals and rubber chemicals.

Naugatuck, which now operates government-owned synthetic rubber plants in Port Neches, Texas, and Naugatuck, Conn., also has a vital interest in the government's synthetic rubber plant disposal program. John P. Coe, vice-president in charge of U. S. Rubber's interests in the transfer of the synthetic rubber plants from government to private industry, is now preparing bids on several synthetic rubber plants offered for sale under the program.

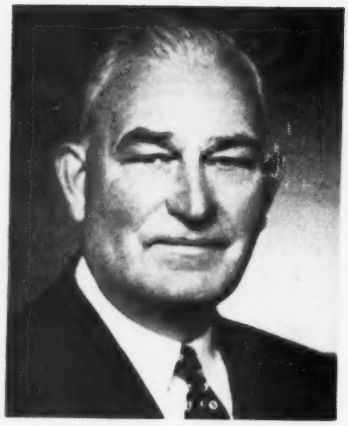
"Lumped together, these facts show Naugatuck Chemical to be a lusty youngster rather than an old-timer pausing on its 50th anniversary to catch its breath," Mr. Caskey declared.

Started in 1904 in Naugatuck, Conn., as a small plant producing sulfuric acid for rubber reclaiming and brass production, Naugatuck Chemical today makes more than three hundred products. It is said to be the country's largest producer of rubber chemicals, and the third largest producer of vinyl resins. It is also a producer of reclaimed rubber.

Achieves Many Firsts

During its fifty years, the division has achieved many firsts. It developed the first method for concentrating and utilizing natural rubber latex back in the 1920's. As the demand for latex compounds increased, Naugatuck Chemical made available to other manufacturers a line of products called "Lotols" in which latex was specifically compounded or otherwise modified to provide desired viscosity, adhesiveness, curing characteristics or other properties for special applications.

When the Japanese closed the door to the Far Eastern rubber plantations, Naugatuck Chemical was prepared to help fashion a rubber industry to replace the output of a billion rubber trees. Starting in 1925, a small synthetic rubber pilot plant was operated at Naugatuck for several years to conduct experiments inspired by its basic research in this field. In this pilot plant the process for making butadiene from alcohol was investigated.



John E. Caskey

Vice-president and general manager of the Naugatuck Chemical Division

In 1940, the pilot plant work was resumed when it appeared that synthetic rubber production might soon become a strategic activity. The company concentrated on synthetic rubber formulations. Particular attention was given to the chemical dodecyl mercaptan which, it had been found, made possible the tailoring of synthetic rubber to any desired viscosity from a soupy mush to that of a hard bark-like material.

Naugatuck chemists worked out a process to make the chemical and called it OEI, which was later appropriately nicknamed the "one essential ingredient." By the time the United States entered the war, the chemical plant was producing OEI and was familiar with its use in making synthetic rubber.

It followed then, when government and industry experts drew up plans for the American synthetic rubber industry, Naugatuck was prepared immediately to expand production of this essential material. It operated a government plant which supplied the major portion of the synthetic rubber modifier used during the second world war.

Pioneer in Synthetic Rubber

Naugatuck Chemical also pioneered in synthetic rubber production, designing and building one of the first three plants. Later, many of the process and design features originated here were adopted in establishing the government's standard plant synthetic rubber program. The company has also led the way in improving this product. Its laboratories have succeeded in developing a great many new varieties of synthetic rubber.

It was fundamental research in synthetic rubber production, back in the 1920's, that

Shown above is the building which housed the general offices of the Naugatuck Chemical Division of the U. S. Rubber Co. when the division was formed in 1901.

led Naugatuck Chemical into the production of plastics. One particular need which presented itself during the war years was a tough cover for self-sealing fuel cells. The problem was solved by making a cover using polyester resin and glass fibers in late 1942. It was one of the first uses for reinforced plastics, and as an outgrowth of this work, the division started production of "Vibrin" polyester resin.

From these war-time uses, Vibrin has entered many fields. In 1952 the Glasspar Co. of California, sponsored by Naugatuck Chemical, used Vibrin to make the first commercially produced plastic car body. It is being used today in cars, truck and house trailers, flat and corrugated sheets for the building industry, boats, truck doors, windows, machine housings and many other things.

In 1945 rubber and plastic were combined in a new plastic, Kralastic. Corrosion-resistant, dimensionally stable, rigid and with the highest impact resistance yet developed in plastics, Kralastic is fast becoming one of Naugatuck Chemical's most important products. It is being used in pipe and many other molded products.

In late 1949, Naugatuck Chemical purchased the Plastics Department of the Glenn L. Martin Co., and entered the vinyl field with Marvinol vinyl resin. It is now the third largest producer of vinyl resins in the country. It has also done notable pioneering work in the field of rigid and expanded vinyls. Last year it introduced a method for bonding rigid vinyl film to sheet steel and aluminum, thus combining the beauty and corrosion resistance of vinyl with the structural strength of metal. New products, using this new process, are just starting to come on the market, Naugatuck states.

Naugatuck Chemical's 50 years in the chemical business have resulted in a long list of new products that affected many of America's industries. Rubber has been made a versatile material, capable of jobs once thought impossible. Plastics, agricultural chemicals, latex compounds and other products have all increased the efficiency of man, and raised America's standard of living. But viewed in retrospect, all of this work merely points to the much brighter future ahead for Naugatuck Chemical.

Current executives of the division, all of whom were present at the luncheon at the Metropolitan Club, include: John E. Caskey, vice-president and general manager; George R. Vila, assistant general manager; Robert E. Casey, general sales manager; Harold M. Parsekian, assistant general sales manager; William H. MacHale, advertising manager; Christy H. Madsen, production manager; D. Loren Schoene, assistant director of research and development; Clayton F. Ruebensaal, commercial development manager; Joseph P. Monahan, general control manager, and Russell S. Tobias, division purchasing agent.

New type canvas shoe covers coated with Geon vinyl plastic are now being used at one of the Atomic Energy Commission plants at Oak Ridge, Tenn.

FUNCTIONAL EFFICIENCY MARKS NEW STOWE-WOODWARD GEORGIA PLANT

The new plant of Stowe-Woodward, Inc., at Griffin, Georgia, is said to mark a significant advance in rubber roll production. The plant, seen above, is designed solely for the processing of the highly-specialized rubber roll coverings used in modern papermaking and textile finishing. When completed, about December of this year, the plant will be equipped with the most modern facilities. Built for the future, provision has been made for easy handling of the largest rolls used in the paper and textile industries. Operation of the Griffin plant will follow very closely the recent opening of a second branch plant at Neenah, Wisc. Both new operations duplicate the facilities of the company's headquarters at Newton, Mass.

To Build Conveyor in Buffalo

Thomas Robins, Jr., president of Hewitt-Robins Inc., Stamford, Conn., recently told the Buffalo, N. Y., Chamber of Commerce that his company's engineers are working on the development of a passenger conveyor that would be suitable for use in the New York Central railroad station in Buffalo to carry passengers up one or more of the long ramps leading from the train level to the first floor of the station. Mr. Robins said the conveyor will consist of a rubber belt about six feet wide which will ride on flat rollers at a speed of 1½ miles per hour, which is about half the average walking speed. Passengers could walk on the belt and reach the top of the ramp in half the time it would normally require. Hewitt-Robins will build both the machinery and belting for the conveyor.

Completes New Acrylates Unit

A new unit for the commercial production of high purity grades of ethyl and methyl acrylates has been completed at the Institute, West Va., plant of the Carbide & Carbon Chemicals Co. Production facilities of the new unit represent a substantial expansion of the company's previous capacity for the manufacture of these polymer and copolymer intermediates. This unit can also be used for the production of other esters of acrylic acid. Increased production of these acrylic products, the company says, will afford a continuous large volume of supply for manufacturers of polymers and copolymers useful in the latex paint field, in plastics, and in the textile, paper, leather and oil industries.

Silicone Packaging Unit

A seamless hand-folded packaging unit, providing easier and safer handling of silicone rubber compounds, has been designed for the Silicone Products Department of the General Electric Co. by the Albany Corrugated Box Co. of Cohoes, N. Y. Considered an innovation in the industrial packaging field, the container's sides have five thicknesses of board for stacking strength, thereby eliminating the possibility of collapse under weight. Used for shipments of compounds to G-E customers, the package does not require staples. Though the new container holds 50 pounds of rubber, it is lighter and more easily handled than the conventional pails and cartons formerly employed for this purpose. A polyethylene liner in the box seals out moisture, dirt and other foreign substances. The package can be quickly opened by splitting two tapes, and its contents placed directly in the mills at the fabricator's plant. If only part of the silicone material is used, the containers can be thoroughly resealed and the contents preserved for future use. The packaging design is said to have made possible a standardization of packing both sheet and bulk type silicone rubber materials.

Rubber Division Directory

The Division of Rubber Chemistry of the American Chemical Society has issued its latest directory, this one dated April 15, 1954. As usual, the directory contains a listing of current officers, the by-laws of the organization, and an alphabetical listing of all members and associate members.

NAMES IN THE NEWS

JACK BRITT, formerly associated with the Bureau of Ships, U. S. Navy, has been named Washington, D. C., representative for the Sponge Rubber Products Co., succeeding ROBERT GREINER.

ROY WALLACE, associated with the Goodyear Tire & Rubber Co. since 1948, has been named manager of the central sales district of the Chemical Division of the company with headquarters in Cleveland. JOHN H. DREXLER has been named special sales representative in the same district.

EDWARD H. WEITZEN, formerly vice-president of the Bulova Watch Co., has joined the American Machine & Foundry Co. as vice-president in charge of marketing.

KENNETH M. KASHDAN has been appointed special sales representative for the handbag, luggage and related leather goods industries, by the Rubber & Asbestos Corp.

RAYMOND C. FIRESTONE, executive vice-president of the Firestone Tire & Rubber Co., was honored two days after the 1954 Memorial Day 500-mile race at a special awards dinner in Indianapolis where he was presented with the Edenburn Trophy as "the person connected with automobile racing deemed to have contributed the most to that sport during the year."

PETER G. SLOAN has been named Ohio sales representative for the Goshen Rubber Co., Inc. of Goshen, Ind.

JAMES W. KETTLE, formerly assistant director of the Cost and Statistics Division of the U. S. Steel Corp., has been appointed controller of the Stauffer Chemical Co., its subsidiaries and affiliated companies.

JOHN P. ALRADE, associated with the Minnesota Mining & Manufacturing Co. since 1947, has been named western area sales manager of the Adhesives and Coatings Division.

E. C. SAUTER, associated with the Goodyear Tire & Rubber Co. since 1921, has been named manager of cycle tire sales succeeding M. F. Moyer, who has been named assistant manager of the Auto Tire Sales Department.

LYNN FROST, formerly advertising manager of Hewitt-Robins Inc., has been promoted to the newly-created position of merchandising and sales promotion manager of the company's Restfoam Division.

WILLIAM C. PRETTYMAN, formerly associated with the Chicago sales staff of the Reliance Electric & Engineering Co., has been appointed to the sales application engineering staff in New York City.

FRED DENIG, vice-president in charge of the Production Department, Central Staff, of the Koppers Co., Inc., has been elevated to the grade of Fellow in the American Society of Mechanical Engineers.

E. J. DUNLAVY, JR., former Vinylfilm sales representative for the Goodyear Tire & Rubber Co. in New York, has been assigned to the company's Vinylfilm sales staff in Akron.

EDWARD LEBO, public relations director of Hewitt-Robins Inc., has been given the added responsibility of advertising manager.

DENIS P. MOCHARY, a vice-president and a director of the Baird Rubber & Trading Co., Inc., has retired from the firm after an association of twenty years.

W. H. PENDER, associated with the Quaker Rubber Corp. since 1947, has been named manager of belting sales for the company.

MILTON E. CASE, formerly associated with Dan River Mills, Inc., has been named chief internal auditor of the Robertshaw-Fulton Controls Co.

A. W. EWY, assistant auditor of the Gates Rubber Co., Denver, Colo., has been elected president of the Denver Chapter of the National Association of Cost Accountants.

J. P. LOFTUS has been assigned special sales duties in the greater New York City area and T. R. JOHNSTON has been appointed Rochester, N. Y., district field manager for the Associated Tires & Accessories Division of the B. F. Goodrich Co.

M. BILL PLUMEE, associated with the B. F. Goodrich Co. since 1951, has been named personnel manager of the Cadillac, Mich., plant of the company's Industrial Products Division.

J. P. SEIBERLING, president and chairman of the board of the Seiberling Rubber Co., received the honorary degree of doctor of laws from the University of Akron during commencement exercises on June 15.

FENMORE E. DUNN, associated with the Worthington Corp. since 1950, has been named general manager of the Vertical Turbine Pump Division of the company.

STANLEY W. LOVEJOY, formerly associated with the General Electric Co., has been named manager of cutting tool research of Pratt & Whitney, a division of the Niles-Bement-Pond Co.

Hecht Opens New York Office

Dr. Ernest H. Hecht

Dr. Ernest H. Hecht, formerly general manager of the Ideal Rubber Co., has opened an office at 1133 Broadway, New York 10, N. Y., as a manufacturers' representative. Mr. Hecht is now representing a number of German concerns in the United States and Canada. All of the firms produce steel wire and other types of steel articles finding use in the rubber industry. These firms include: Bremer Dracht — und Seilindustrie, Bremen — Hemelingen; Hahn & Co., Altena (Westf.); Wilh. Meese & Soehne, Altena (Westf.); Rosenkaimer G. m. b. H., Leichlingen, Rhld., and Wagener & Co., Altena (Westf.).

DR. AUGUSTUS B. KINZEL, associated with the Union Carbide and Carbon Corp. since 1926, has been named director of research for the company.

H. W. ROLLMAN, co-founder and president of Wellco-Ro-Search, is the subject of a case history appearing in a book called "100 Stories of Business Success" published by Simon & Schuster.

DR. CHARLES SCOTT VENABLE has retired as director of chemical research of the American Viscose Corp. after 22 years of service. He will remain with the corporation in a consulting capacity.

T. V. HAUSE is now representing Oakite Products, Inc., in Hartford, Conn. Mr. Hause recently completed an intensive, eight-week training course at the company's New York headquarters.

DONALD B. BENEDICT, associated with the Carbide and Carbon Chemicals Co. since 1933, has been named works manager of the company.

JOHN S. DE NOIA, associated with the Permacel Tape Corp. since 1940, has been named assistant industrial sales manager.

DONALD O. AGNEW, associated with the B. F. Goodrich Co. for the past eighteen years, has been appointed field manager of special accounts for the Associated Tires and Accessories Division of the Tire & Equipment Division, B. F. Goodrich Co.

U. S. Rubber Promotes Noonan

Chester J. Noonan

Chester J. Noonan, vice-president of the U. S. Rubber Co., New York, N. Y., has been appointed to the newly-created position of executive general manager of the company's Footwear and General Products Division and the Mechanical Goods Division. Since July, 1953, Mr. Noonan has been vice-president of the company and general manager of the Footwear and General Products Division. He started with U. S. Rubber in 1919 as a clerk in Great Falls, Mont. A year later he became a salesman in Butte and was appointed footwear sales manager in Salt Lake City in 1922 and in Los Angeles in 1929. He was Pacific Coast sales manager from 1933 to 1938, when he was made manager of clothing and coated fabric sales. In 1943, he was appointed general sales manager of the Footwear and General Products Division and in 1950 assistant general manager.

Reid Appointed Factory Manager

U. S. Rubber Co., New York, N. Y., has appointed Herbert J. Reid factory manager of the Fort Wayne, Ind., plant of the company's Mechanical Goods Division. Mr. Reid assumes his new post less than a year after becoming assistant factory manager. He joined U. S. Rubber in 1931, as a laboratory assistant. In 1939, after four years as a development chemist, he became a development group leader in the Providence, R. I., plant of the Mechanical Goods Division. Mr. Reid held posts as technical superintendent and general superintendent of the Gilmer plant in Philadelphia, Penna., before he was named assistant to the production manager of mechanical goods in 1953.

Appointed Vice-President

L. M. Johnson, formerly general manager of the Johnson Rubber Co., Middlefield, Ohio, and more recently associated with the Chardon Rubber Co., Chardon, Ohio, as well as a partner in the Johnson Sperry Rubber & Plastics Co. of Middlefield, has been appointed vice-president in charge of sales for Geauga Industries Co., Inc., also of Middlefield. Mr. Johnson has also been named a director of Geauga Industries.

Olin and Mathieson to Merge

Stockholders of Olin Industries, Inc. and the Mathieson Chemical Corp. have voted approval of a merger, presidents of the two companies announced on June 29. The new company, Olin Mathieson Chemical Corp., will have assets of about $500,000,000 and sales of more than that amount, they said. It was stated that the effective date of the merger will be announced soon. Under the new arrangement, John M. Olin, president of Olin Industries, will become chairman of the board of the new company, while Thomas S. Nichols, president of Mathieson, will occupy the same position in the new company. John W. Hanes, financial vice-president of Olin, will be chairman of the Finance Committee of the new corporation. Both companies were founded in 1892 and both are about the same size. Olin Mathieson will have about 36,000 employees. Forty-three of its plants are located in the United States and sixteen abroad.

Goodrich Sues U. S. Rubber

B. F. Goodrich Co. filed a Federal Court suit on June 29 in Baltimore accusing the U. S. Rubber Co. of infringing on its tubeless tire patent rights. Goodrich asked the court to enjoin its competitor from the alleged infringement and to award damages for previous violations. The suit said the tubeless tire was invented by Goodrich and has been in production since 1947. A similar suit was filed against the Firestone Tire & Rubber Co. in May, 1953. In New York, U. S. Rubber stated that there is no merit in the suit brought against it by Goodrich. U. S. Rubber stated that it believes the patent is invalid. Tubeless tires, it added, had been developed and tested by several rubber companies and individuals many years prior to the date of the Goodrich patent. U. S. Rubber, it continued, developed, tested and found workable tubeless tires as long ago as 1934.

Acushnet Advances Executives

At a recent board meeting of the Acushnet Process Co., New Bedford, Mass., Richard B. Young was elected treasurer and Karl B. Goodwin, second vice-president and director of sales for the Rubber Division, was elected to membership on the board of directors. Both Mr. Young and Mr. Goodwin joined the company in 1938, and both are graduates of the Massachusetts Institute of Technology. Mr. Young started as a trainee, serving a full apprenticeship in practically all departments. He was assistant to the factory manager and later became factory manager, before he was assigned to the Sales Department. Mr. Goodwin started in the Engineering Department of the Rubber Division. After serving as assistant to the factory manager, he was promoted to director of sales. In 1953, he was elected vice-president.

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BWH Appoints Research Director

Norman J. Cyphers

Norman J. Cyphers has been named director of research and development of the Boston Woven Hose & Rubber Co., Cambridge, Mass. Prior to his appointment, Mr. Cyphers was vice-president and technical director of the Acme-Hamilton Manufacturing Co. He had also been associated with the Hewitt Rubber Co. for six years as technical supervisor. A graduate of Syracuse University with a B.S. in chemical engineering, Mr. Cyphers is a member of the Rubber Division of the American Chemical Society, the Rubber Manufacturers Association and the Trenton Engineers Club.

Opens New Accelerator Plant

A new, modern rubber chemical accelerator plant which more than doubles present production was opened on June 1 by the American Cyanamid Co., at its Bound Brook, N. J., plant, according to an announcement by Dr. Victor E. Wellman, manager of the company's Intermediates and Rubber Chemicals Department. The new plant is devoted exclusively to the production of Cyanamid's "NOBS" and "NOBS No. 1" accelerators. "The opening of this new plant for NOBS and NOBS No. 1 accelerators, which more than doubles our production output, insures ready availability of these two products to meet all present demands," said Dr. Wellman. Both accelerators were developed by American Cyanamid for use in reinforcing (high pH) furnace blacks in natural rubber and GR-S. NOBS was designed for use where special protection is essential.

Named New Products Manager

H. Leon Moran has been appointed new products manager for the Mechanical Goods Division of the U. S. Rubber Co., New York, N. Y. In the newly-created post, Mr. Moran will be responsible for speeding the adoption and commercialization of new products. Formerly factory manager of the division's Fort Wayne, Ind., plant, Mr. Moran joined U. S. Rubber in 1922, as a laboratory assistant. He was selected for executive training and in succeeding years held increasingly responsible positions. He became superintendent of a major division in 1945 and general superintendent later that year.

Price Named General Manager

Robert S. Price

Robert S. Price has been appointed general manager of the Plastics Division of the Seiberling Rubber Co., Akron, Ohio. In the newly-created position, Mr. Price will be responsible for all operations of the division, which was formed late in 1953. Seiberling initially will process rigid plastics in a new plant now being built in Newcomerstown, Ohio. Before joining Seiberling, Mr. Price was general manager of the B. F. Goodrich Co. Plastics Division at Marietta, Ohio. He received the B.A. degree in chemical engineering and the M.A. degree in chemistry from Bucknell University.

Changes In American Enka Staff

American Enka Corp., New York, N. Y., has announced the promotion of Dr. J. L. Bitter as vice-president for research and development, Gordon V. Hager as treasurer of the company, and C. Chester Bassett, Jr., as general sales manager in charge of the Sales Division. Dr. Bitter has been director of research for American Enka since 1949. Mr. Hager joined the company in 1947 and has been assistant treasurer since 1949. Mr. Bassett joined the company in 1953 as special assistant to the president for sales and product development. American Enka operations will now be centered in four divisions: the Finance Division, the Manufacturing Division, the Research and Development Division and the Sales Division.

Field Testing "Adiprene" B

E. I. du Pont de Nemours & Co., Inc., of Wilmington, Del., has announced that its experimental "Adiprene" B urethane rubber has reached the field testing stage of development. Adiprene B is believed to possess excellent abrasion resistance, and has displayed high tensile strength as well as resistance to oxygen and ozone degradation. At present, however, Adiprene B is difficult to process. Samples for general evaluation will not be available until the new rubber has undergone further development work and field tests.

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Tracerlab Plans Symposium

A symposium on the "Applications of Radioactivity in the Rubber and Plastics Industries" will be held in Boston, Mass., at the Sheraton-Plaza Hotel, October 6th through 8th, under the sponsorship of the Technical Division of Tracerlab, Inc. The aim of the symposium is to acquaint members of the plastics and rubber industries with the past uses, and possible future applications, of radioisotopes in research, development and process control. The first day will be devoted to orientation talks directed to those persons who are contemplating the use of isotopes. Lectures on the fundamentals of radioactivity, establishing a radioactivity laboratory, AEC regulations, health physics problems, training of personnel, and other basic topics will be given. The second and third day will be taken up by technical papers presented by outstanding speakers from industry, academic research institutions and the Atomic Energy Commission. The speakers will present original papers and lead discussions on such topics as the kinetics of polymerization, initiations of polymerization by ionizing radiation, wear tests, migration and self-diffusion and liquid level and thickness gauging. The registration fee will include admission to all sessions, abstracts of talks, and a dinner preceded by a cocktail party on October 6th, featuring a speech by a nationally prominent figure in the field of atomic energy. Further information can be obtained by writing the Symposium Committee, Technical Division, Tracerlab, Inc., 130 High Street, Boston 10, Mass.

Tyer Rubber Revises Stock

At the annual meeting of the stockholders of Tyer Rubber Co., Andover, Mass., held on May 17, 1954, it was voted to eliminate the 50,000 shares of authorized common stock without par value, comprising part of the present capitalization of the company and to substitute therefor 150,000 shares of common stock having a par value of $10.00 per share. Each stockholder is now the owner of 3 shares of the new $10.00 par value common stock for each share of common stock without par value registered in his name on the books of the company on May 17, 1954. Stockholders are to retain their present certificates. The company will issue 2 additional shares of the new stock for each share of the old stock.

Currently Active Polymers

The Office of Synthetic Rubber, Reconstruction Finance Corporation, has issued a new list of currently active experimental polymers. Those experimental polymers not shown here have been discontinued or replaced by permanent numbered polymers. Since these are experimental polymers, their availability at the time of ordering should be ascertained by inquiring of the Sales Division, Office of Synthetic Rubber. Active experimental polymers as of June 10, 1954, follow:

GR-S X-617 Latex	GR-S X-734 Latex
GR-S X-633 Latex	GR-S X-750 Latex
GR-S X-667 Latex	GR-S X-760 Latex
GR-S X-684 Latex	GR-S X-757
GR-S X-710 Latex	GR-S X-759
GR-S X-711 Latex	GR-S X-762
GR-S X-763	

Stauffer Appoints Gunder

Roger W. Gunder

Roger W. Gunder has been promoted to western sales manager of the Stauffer Chemical Co., New York, N. Y. Mr. Gunder has been associated with Stauffer for 20 years and before his new appointment was manager of the Los Angeles sales district. His new headquarters will be in San Francisco.

New Ohio-Apex Plasticizers

Four new plasticizers, "Dinopol IDO", "Adipol 810", "Kronitex K-3", and "Kronitex MX" plasticizers were recently announced by the Ohio-Apex Division of the Food Machinery and Chemical Corp., Nitro, West Va. Dinopol IDO (iso-decyl octyl phthalate) is a primary vinyl plasticizer comparable in price and in most of its properties to DOP, but producing plastics with much lower air loss, the company states. Adipol 810 (iso-decyl octyl adipate) is a primary vinyl plasticizer comparable in low temperature flexibility properties and in price to the octyl adipates but with much lower volatility. Kronitex K-3 (tricresyl phosphate) is a primary vinyl plasticizer with comparable properties to other tricresyl phosphates but has a lower specific gravity and lower volatility. Kronitex MX (tricresyl phosphate) is a primary vinyl plasticizer with most properties common to other tricresyl phosphates but has a much lower viscosity and better low temperature flexibility.

Sun Announces Staff Changes

Sun Rubber Co., of Barberton, Ohio, has announced three recent appointments and one new addition to its staff. Blair R. Lampert, who joined Sun in 1953, has been named manager of the Consumer Sales Department. Richard L. Marion, who was Sun's sales engineer, is now manager of the Contract Sales Division; and Vaughn Valentine, formerly chief chemist in plastics, will serve as superintendent of vinyl product production. A new addition to the company is Gerald Marks, who has been made senior expediter and assistant to W. R. Lantz, vice-president and purchasing agent. Mr. Marks was formerly associated with the B. F. Goodrich Co., Seiberling Latex Products Co., and the DoAll Co.

DuPont Re-Assigns Byam

Seward G. Byam

Seward G. Byam has been named to the newly-created post of sales manager in charge of technical publications for the Rubber Chemicals Division of E. I. du Pont de Nemours & Co., Inc., of Wilmington, Del. After graduation from Brown University in 1916, Mr. Byam worked as a chemist for the U. S. Rubber Co. and for the U. S. Government's Bureau of Aircraft Production. He joined DuPont in 1919 as chief chemist at the Fairfield, Conn., plant. After an absence of three years, during which he worked for the Plymouth Rubber Co., he returned to DuPont in 1925 as assistant plant manager at Fairfield. He was named manager of development at the Newburgh, N. Y., plant in 1931, and in 1932 was transferred to Wilmington. He became assistant manager for rubber chemicals in 1938 and was appointed assistant manager of the Rubber Laboratory at Deepwater Point, N. J., in 1941, becoming associate Laboratory director in 1943. He was appointed neoprene sales manager in September of 1943. Mr. Byam is a member of the Division of Rubber Chemistry of the ACS and is 1954 chairman of the Charles Goodyear Medal Award Committee.

Indulin-70-GR-S Coprecipitate

A lignin-synthetic rubber coprecipitate, "Indulin-70-GR-S," is now available in commercial quantities from the Polychemicals Division of the West Virginia Pulp and Paper Co., Charleston, S. C. Coprecipitation of Indulin provides a product similar to the black masterbatches produced by the government GR-S plants. Indulin-70-GR-S is produced by adding lignin as an alkaline solution to latex, and then coagulating with acid in the usual way. The resulting coprecipitate may be compounded by rubber processors either with or without the addition of other filler pigments or rubber, and with the usual curing chemicals. Cured rubber stocks using Indulin-70-GR-S are said to have high tensile strength, good water resistance, good flex life and low flex crack growth, as well as low modulus, high elongation and high tear resistance.

U. S. Rubber Promotes McCracken

Homer O. McCracken has been named assistant factory manager of the Fort Wayne, Ind., plant of the Mechanical Goods Division, U. S. Rubber Co. Mr. McCracken was formerly factory coordinator for the division in the treasurer's department in New York City. He attended Franklin College, Franklin, Ind., where he received a liberal arts degree. In 1939, he joined the company at the Indianapolis tire plant. Mr. McCracken was transferred to the Tire Control Section as a clerk shortly thereafter. He was a bookkeeper in 1940, supervisor of general accounts the following year, and group supervisor two years later. Still within the Tire Control Section, Mr. McCracken became chief accountant in 1944, administrative assistant later the same year, and held both positions from 1946 until 1951 when he was called to the New York offices and transferred to the Mechanical Goods Division.

Introduces Styron 480

Dow Chemical Co., Midland, Mich., reports that it has added an extra-tough polystyrene to its line of plastics. Known as "Styron 480," the new plastic is claimed to be ten times more rugged than general purpose polystyrene and twice as strong as any other polystyrene Dow has had to offer. Right now, the new material is going into refrigerator pans and drawers, but the company has field tested it for use in such products as action toys, portable radio cabinets, film reels and hearing aid cases. Parts fabricated with Styron 480 can be stapled and metal inserts molded in with ease, Dow states. Among other things, the material can be stamped, embossed and vacuum and pressure formed, and it can be extruded into shape or sheet as well as fabricated on regular injection molding machines. Costs, the company says, are about 20% more than general purpose polystyrene.

Battelle Institute Expanding

Battelle Institute, Columbus, Ohio, has just completed the purchase of a 397-acre plot of land fifteen miles west of downtown Columbus. According to Dr. Clyde Williams, president and director of Battelle, the acreage is needed because of newly-developed opportunity for Battelle to engage in more large-scale experimental projects in engineering and agricultural fields. Battelle has conducted an almost continuous expansion program since 1935. Indicative of the research center's growth is its increase in personnel. The present staff of 2150 is more than double that employed at the close of World War II. Its dollar volume of research was $13,500,000 in 1953.

Wohlend Joins Stauffer Chemical

Alfred N. Wohlend has joined the technical sales staff of the Stauffer Chemical Co., New York, N. Y. Mr. Wohlend, a chemical engineering graduate of the University of Michigan, is a specialist in the marketing of organic chemicals. He was formerly president of Gator Chemicals, Inc., St. Petersburg, Fla. The new appointment is effective immediately and Mr. Wohlend will headquarter in the company's New York offices.

Joins Narmco Metlbond Co.

Gerald Reinsmith

Gerald Reinsmith, formerly office manager for Narmco, Inc. in Washington, D. C., has been named factory manager of the Narmco Metlbond Co., Chino, Calif. Prior to his employment with Narmco, Inc., Mr. Reinsmith was associated with the U. S. Army Ordnance Department where he was chief of the Non-Metallic Structural Materials Unit in charge of the research, development and application of non-metallic materials in Ordnance items. During his career, he has also been associated with the U. S. Army Chemical Warfare Service, the Dow Chemical Co. and the public school system of Midland, Mich. A graduate of the Central Michigan College of Education with a B. A. degree, Mr. Reinsmith took post graduate work at the University of Michigan. He has contributed many papers to the technical literature and has delivered many talks before various rubber groups and technical associations. He is a member of ACS, SAE, ASTM, SPI, SPE, and ASME.

8th Chemical Exposition News

An all-day symposium on the transportation, packaging and labeling of chemicals will be held on October 13 in Chicago, Ill., during the Eighth National Chemical Exposition at the Chicago Coliseum (October 12-15). The symposium will cover four major topics: The Economics of Chemical Transportation, Bulk Transportation of Chemicals, The Precautionary Labeling of Hazardous Materials, and The Smaller Bulk Containers. The Manufacturing Chemists' Association has arranged the symposium, which will feature papers and panel discussions by leading members of the chemical industry.

Goodrich Building Warehouse

Construction of a new, one-story brick and steel district office and warehouse in the Santa Fe industrial district of Oklahoma City, Okla., has been announced by the B. F. Goodrich Co. Tire & Equipment Division, Akron, Ohio. The structure is expected to be ready for occupancy by October 1, and will stock passenger and truck tires and tubes for distribution in the Oklahoma City district.

NEW POLYMERS AUTHORIZED BY OFFICE OF SYNTHETIC RUBBER, RECONSTRUCTION FINANCE CORPORATION

Listed below are types and properties of new experimental GR-S polymers (including GR-S latices) which have been authorized by the Office of Synthetic Rubber, Reconstruction Finance Corporation, since publication of those in our previous issue. Procedures for the distribution and sale of the polymers will be found in our October, 1945, issue. Normally, experimental polymers will be produced only at the request of the consumers and 20 bales (one bale weighs approximately 75 pounds) of the original run will be set aside if possible for distribution to other interested companies for their evaluation. The 20 bales when available will be distributed in quantities of one or two bales upon request to the Synthetic Rubber Sales Division or will be held for six months after the experimental polymer was produced unless otherwise consigned before that time. Subsequent production runs will be made if sufficient requests are received to warrant them.

X No.	*Polymer Description*	*Remarks*
X-759 GR-S	Butadiene/styrene charge ratio 70/30 adjusted to yield 23.5 ± 1.0% bound styrene, hydroperoxide-sugar activated, fatty acid soap emulsified, 122°F. reaction temperature, 68% conversion. Carbamate shortstopped, staining antioxidant, salt-acid coagulated, Mooney viscosity 44-52 ML-4 at 212°F.	Identical with GR-S 1000 except for hydroperoxide-sugar activation instead of potassium persulfate and carbamate as shortstop instead of hydroquinone. Results of consumers' evaluation will determine whether activated recipe will be adopted for all "hot" polymers.
X-760 GR-S Latex	Butadiene/styrene charge ratio 70/30 adjusted to yield 25.0 ± 2.0% bound styrene, sulfoxylate activated, 65/35 rosin/fatty acid soap emulsified, 50°F. reaction temperature, 60% conversion. Carbamate shortstopped, potassium oleate stabilized, mean Mooney viscosity of contained polymer 140 ML-4 at 212°F. Latex heat concentrated to 47.0-50.0% total solids.	Identical with GR-S X-758 except for the lower total solids range. Developed as possible replacement for GR-S 2100.
X-761 GR-S	Butadiene/styrene charge ratio 70/30 adjusted to yield 23.5 ± 1.0% bound styrene, sugar-free iron activated, rosin acid soap emulsified, 41°F. reaction temperature, 60% conversion. Carbamate shortstopped, staining antioxidant, salt-acid coagulated, Mooney viscosity 46-58 ML-4 at 212°F.	Identical with GR-S 1500 except that it is produced under specially controlled conditions for use by GR-S producing plants as the standard reference control test bale.
X-762 GR-S	Butadiene/styrene charge ratio 70/30 adjusted to yield 23.5 ± 1.0% bound styrene, sugar-free iron activated, 50/50 rosin/fatty acid soap emulsified, 41°F. reaction temperature, 60% conversion. Carbamate shortstopped, staining antioxidant salt-acid coagulated, Mooney viscosity 46-58 ML-4 at 212°F.	Identical with GR-S 1500 except that it is emulsified with a 50/50 mixture of rosin and fatty acid soaps instead of straight rosin acid soap.
X-763 GR-S	A masterbatch of 37.5 parts aromatic type processing oil, 50 parts HAF black, and 100 parts base polymer. Polymer—23.5% bound styrene, sugar-free iron activated, 50/50 rosin/fatty acid soap emulsified, 41°F. reaction temperature, 60% conversion, carbamate shortstopped, staining antioxidant, salt-acid coagulated. Compounded Mooney viscosity of masterbatch 55-75 ML-4 at 212°F.	Identical with GR-S 1801 except that it contains 37.5 parts of an aromatic type oil instead of 25 parts of a naphthenic type oil. Possible replacement for GR-S 1801.

NOTE: The above new polymers are experimental only and the Office of Synthetic Rubber, Reconstruction Finance Corporation, does not make any representation or warranties of any kind, express or implied, as to the specifications or properties of such experimental polymers, or the results to be obtained from their use.

Standard Develops C-Oil

A new petrochemical called "C-Oil" has been announced by the Standard Oil Development Co., New York, N. Y. A heavy-bodied, sticky, almost colorless liquid based on butadiene, C-Oil will find use in paints, surface coatings, metal primers and plastics. Sandard Oil Development reports that surface coatings made from C-Oil are so hard it is difficult to scratch through them, and a damp cloth will readily remove stains and smudges because they cannot penetrate the surface. C-Oil coatings have also demonstrated excellent resistance to attack by alkali, dilute acid and water. Glass-like plastics which may be machined almost like metal have been made from the new product, and its unusual electrical properties are said to indicate future use for C-Oil plastics in high frequency electronic equipment. Because it is substantially colorless, C-Oil makes a neutral varnish which brings out the natural grain of wood products. Absence of color also gives this new base stock an advantage in making white paints, the company says.

Develops Anti-Skid Safeguard

Carborundum Co., Niagara Falls, N. Y., has developed a product called the "Highway Safety Grain" which, when applied to a road surface, is said to assure the needed traction between tires and highway to guard against sliding and skidding on wet, slippery roads. The company says that tests indicate that the application of the Highway Safety Grain to highway surfaces can reduce the stopping distance of a car traveling 30 miles per hour by one-third. Carborundum engineers used a fused alumina abrasive material of over 2000 hardness on the Knoop scale. Thus the Highway Safety Grain does not wear smooth, but provides many small, rough protruding surfaces to aid tire traction. Millions of these hard abrasive grains are impregnated in the road surface and increase the holding power of tires even on very slippery roads, the company states.

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Magic-Vulc Neoprene Coating

A new surface coating which will adhere to metal, concrete, wood, plastic, glass and other surfaces, and which will resist the wearing action of oils, alkalis, strong sunlight and sea water, as well as other corrosive solutions, has been developed by the Magic Chemical Co., Brockton, Mass. The "Magic-Vulc Neoprene Maintenance Coating No. 245-B" forms a tough, elastic film which will not crack under extreme weather conditions or rapid temperature changes. A thick, paint-like liquid, which can be brushed or sprayed on most surfaces, the new coating needs no primer or accelerator. It can be used straight from the can and when dry forms a thin protective film, 0.005 to 0.010 inches thick. The standard color is black, but aluminum and other colors are available.

Manhattan Rubber Division of Raybestos-Manhattan, Inc., has issued a new bulletin on Manhattan Cut-Off Wheels which includes recommendations with wheel grade numbers for a wide variety of materials and valuable operating suggestions.

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CANADIAN NEWS

The formation by the Dunlop Rubber Co., Ltd., of a Research Centre in North America, was recently announced by J. P. Anderson, president and general manager of the Dunlop Tire & Rubber Goods Co., Ltd., Toronto. To be closely associated with the Dunlop Research Centre at Birmingham, England, the new Centre will conduct research involving the new materials, chemicals, processes, techniques and equipment peculiar to the rubber industry on this continent.

Dr. Norman S. Grace, formerly chief chemist and technical superintendent of the Dunlop Tire & Rubber Goods Co., has been appointed general manager of the new Centre. His present headquarters are at the company's Toronto plant where technical facilities for the new Centre are now being installed. These will include laboratories for research involving polymer and organic chemicals and a physics department for raw material tests and low temperature studies.

Rapid advances on this continent in many fields affecting the manufacture and construction of rubber products necessitated the formation of the new Centre. It will keep Dunlop's scientists at Birmingham abreast of developments in Canada and the United States and help insure the early adoption of new materials and processes by Dunlop's 46 factories throughout the world.

Much of the new Centre's activity will be concerned with products of the petrochemical and synthetic rubber industries which have progressed further in North America than in Britain. Dr. Grace will also direct research related to mining, road and vehicle engineering, textiles, plastics, and compounding chemicals used to prolong the life of tires and other rubber products.

Born in India, Dr. Grace is a graduate of the University of Saskatchewan. He obtained his Ph.D. at the Imperial College of Science and Technology, University of London. He joined Dunlop in 1939 after post graduate work at the Universities of California and Toronto and being associated with the National Research Council, Ottawa. During the war he was loaned to the Washington office of the Department of Munitions and Supply and to the Polymer Corporation.

At the new Centre Dr. Grace will be assisted by J. A. Carr who has been with Dunlop since 1940. Other members of his staff include Dr. R. T. Woodhams, formerly with the Brooklyn Polytechnic Institute, and A. D. Dingle.

Dr. Grace will continue as technical advisor to Dunlop-Canada which is acting as host company for the new Centre.

Dr. Norman S. Grace

General manager of the new Dunlop Research Centre

Canadian Industries, Ltd. became two separate companies at the close of business on June 30, in accordance with a United States Supreme Court judgment ordering Imperial Chemical Industries, Ltd., and E. I. du Pont de Nemours & Co., Inc., the two principal shareholders, to separate their interests in the Canadian company. The two new companies are Canadian Industries (1954), Ltd., and DuPont of Canada, Ltd.

Canadian Industries (1954), with about 6,000 employees, will operate the chemicals, explosives and ammunition, paints and coated fabrics and plastics departments of the former concern, with plants at Halifax; Shawinigan Falls, Bronsburg, Montreal and Beloeil in Quebec; Cornwall, Chatham, Copper Cliff, Hamilton, New Toronto and Nobel in Ontario; Brainerd, Man.; Calgary and Edmonton, Alberta, and James Island, B. C.

Canadian Industries (1954) also will handle certain resale products including acrylic sheeting; polyvinyl chloride; Plaskon melamine; urea and alkyd plastics; fungicides; mercurial wettable spray; seed treaters and other chemical products.

DuPont of Canada, with about 3,000 employes, will take over firms and textile-fibers plants at Shawinigan Falls and at Maitland and Kingston in Ontario, which manufacture cellophane cellulose film; Polythene film; cellulose sponges and nylon filament and staple fiber. Resale products will include pesticides; orlon; acrylic fiber; dyes; X-ray film; petroleum chemicals; neoprene; refrigerants and plastics molding and extrusion powders.

According to a recent announcement, renovations and extensions to be made at the Polymer Corp. during 1954 will cost about $3,400,000. This is slightly higher than the $3,000,000 expended in 1953. Changes will be made across the plant generally, with no emphasis on particular units. At least $2,500,000 per year is required to keep the plant technically modern, it was disclosed.

It has also been reported that the company is undertaking a $2,000,000 modification of its ethylene producing facilities at Sarnia, Ont. When completed early in 1955, the modified facilities will enable Polymer to produce ethylene "efficiently with good recoveries over a wide range of feedstock composition."

An attempt by five rubber companies to appeal to the Supreme Court of Canada from a sentence in connection with charges of illegal combine operations has been postponed until October. The companies, fined $10,000 each in a Toronto court, sought leave to appeal the case and the Supreme Court directed a re-argument of the motion. At the same time, however, the court adjourned. It will reopen for the fall session on October 5. The five companies involved are the Goodyear Tire & Rubber Co. of Canada, Ltd., Dominion Rubber Co., Ltd., Dunlop Tire & Rubber Goods Co., Ltd., Gutta Percha & Rubber, Ltd., and the B. F. Goodrich Rubber Co. of Canada, Ltd.

William E. Ireland, vice-president of the B. F. Goodrich Rubber Co. of Canada, Ltd., has been elected a director of the company. Mr. Ireland has also been named vice-president-sales, with responsibility for all sales divisions of the Canadian company. He joined the Goodrich organization 20 years ago. During World War II, Mr. Ireland was chief of the Tire and Tube Production Division of the U. S. War Production Board. He returned to active duty with the company in 1945.

Alan L. Francis of the Goodyear Tire & Rubber Co. of Canada, Ltd., has been appointed president of the Council of Canadian Purchasing Associations.

LOS ANGELES NEWS

Fred W. Troester has been added to the sales staff of the Chemical Manufacturing Division of the M. W. Kellogg Co. Mr. Troester has been assigned to the company's Los Angeles office, where he will handle sales of "Kel-F" trifluorochlorthylene polymer molding powders, dispersions, oils, greases and waxes in the Pacific Coast area.

J. O. Ross Engineering Corp. has announced that as of July 1 the company's Los Angeles branch office has moved from the Westinghouse Building to the new Ross plant at 6417 Bandini Boulevard, Los Angeles 22, Calif. R. W. Morsch continues in charge of the office.

The Los Angeles district office of the Bailey Meter Co. has moved to larger quarters at 816 South Atlantic Boulevard, Monterey Park, Calif. The Los Angeles district includes Southern California, the southern tip of Nevada, the State of Arizona, and Hawaii. The office is under the management of L. F. Richardson.

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OBITUARIES

C. Dudley Armstrong

C. Dudley Armstrong, a director and former vice-president and secretary of the Armstrong Cork Co., died on June 8. He was 65 years old. Born in Wilkinsburg, Penna., in 1888, Mr. Armstrong was a grandson of Thomas Morton Armstrong, the founder and first president of Armstrong Cork, and son of Charles Dickey Armstrong, who succeeded his father as president of the company from 1908 to 1929. C. Dudley Armstrong entered the company after his graduation from Yale University in 1910. One of his first assignments was with the company's Spanish subsidiary. Later he served in the Pittsburgh administrative offices and in the Floor Plant in Lancaster, Penna. During the first World War, Mr. Armstrong was a captain in the Chemical Warfare Service. Returning to Armstrong after the war, he was elected first vice-president of the company in 1920. In 1927, he was appointed general manager of the subsidiary Armstrong Cork and Insulation Co., and two years later he was appointed general manager of the Cork Department. Early in the 1930's he was placed in charge of foreign operations and was responsible for reorganizing the company's foreign activities. In 1937, he was elected secretary of the company. Mr. Armstrong retired as vice-president in charge of foreign operations and secretary of the company last September, but remained on the board of directors, of which he had been a member since 1917. He is survived by his wife, two daughters and three sons.

Edward E. Lutwack

Edward E. Lutwack, manager of trade relations for the Goodyear Tire & Rubber Co., died on May 30, after a brief illness. He was 54 years old. Born in Hartford, Conn., Mr. Lutwack was graduated from the U. S. Military Academy at West Point and served in the Army as a commissioned officer from 1923 to 1925. In 1927 he joined Goodyear as a service representative and general line salesman in Charlotte, N. C. From 1930 to 1942 he served the company as a special representative in Memphis, Tenn., as staffman in the Petroleum Sales Department in Akron, Ohio, general line salesman in Cincinnati, Ohio, a member of the sales promotion department in Akron and as district manager in Jacksonville, Fla. During World War II, Mr. Lutwack was a lieutenant colonel in the U. S. Army Air Force. He returned to Goodyear in 1945 as district manager in Milwaukee, Wisc. In 1952 he became assistant manager of trade relations and in December of that year was appointed manager of the department. A colonel in the Air Force Reserve, Mr. Lutwack is survived by his wife, a son and a daughter.

Walter N. Bangham

Walter N. Bangham, a leading authority on rubber plant breeding and a former director of plant research for the Goodyear Rubber Plantations Co., died in Sumatra, after he had undergone an operation for appendicitis. He was 51 years old. Mr. Bangham had been in Sumatra for three months on a special assignment for Goodyear plantations. Born in Wilmington, Ohio, on May 4, 1903, Mr. Bangham was graduated from Ohio State University in 1929 and was sent to Sumatra by the company. He was winner of the William F. Sheldon Travelling Fellowship for study of botany and agriculture. In 1939 he served as chief botanist at Goodyear's Costa Rica plantation, and was a member of the advisory committee of the Inter-American Institute of Agricultural Sciences at Turrialba, Costa Rica. Mr. Bangham developed a bud-grafting operation which increased the yield of rubber trees on Goodyear plantations and has been adopted by private plantations in Indonesia. In 1947, he left Goodyear to become editor of "La Hacienda" in New York, a magazine devoted to tropical agriculture. He continued to serve Goodyear as a consultant. The author of many articles on rubber plant breeding and diseases, Mr. Bangham is survived by his wife.

William Gates, Jr.

William Gates, Jr., chief patent counsel to the U. S. Rubber Co., died on May 29 in White Plains, N. Y. He was 60 years old. Mr. Gates served U. S. Rubber through the law firm of Arthur, Dry and Dole, New York City, in which he was a partner. He had been a member of the firm for the past eight years. Born in Scottsdale, Penna., in 1893, Mr. Gates received the B.A. and LL.B. degrees from Harvard University. He entered the field of patent law with the firm of Roberts, Cushman and Woodberry in Boston, Mass., after several years of specializing in admiralty causes. During World War II, he handled patent work for the United States Office of Scientific Research and Development. Mr. Gates was a member of the New York City and American Bar Associations, as well as the New York Patent Law Association and the American Patent Law Association.

Andrew D. Level, Sr.

Andrew Duarte Level, Sr., retired export manager of the Garlock Packing Co., died on June 25 at his home in East Orange, N. J. He was 72 years old. Born in Venezuela, Mr. Level was graduated from Peekskill Military Academy and Cornell University. He retired from Garlock Packing in 1944. Surviving are his wife and a son.

Miss Cornelia Carden

Miss Cornelia Carden, who retired about two years ago from the secretaryship of the Institution of the Rubber Industry, died on June 21 in Ealing, England. Miss Carden accepted the first paid position with the Institution in March, 1922. She succeeded to the secretaryship following the death of W. F. Virgil Cox in 1940. Her retirement was marked by a gift of diamonds which were presented on behalf of the members by Lord (then Sir Clive) Baillieu, president of the Institution, on the occasion of the Seventh Foundation Lecture delivered at Wolverhampton on May 23, 1952. Subsequently, she received a set of desk appointments as a gift from the members of the Australasian Section. The funeral was held on June 24 at South Ealing Cemetery.

Hector Plansoen

Hector Plansoen, vice-president and director of the Federal Leather Co., died on May 13 at his home in Upper Montclair, N. J., after a brief illness. He was 68 years old. Born in The Netherlands, Mr. Plansoen came to this country in 1909. He was associated with the Hammerslee Paper Mill and served as chief engineer for the Hemming Manufacturing Co., before founding the Federal Leather Co. in 1919, together with his brothers, Louis and the late John Plansoen. Mr. Plansoen was a member of the National Engineers Association of Passaic. He is survived by his brother, Louis Plansoen, another brother, Leonard, and four sisters.

Frank W. Dodge

Frank W. Dodge retired vice-president and general manager of the Seamless Rubber Co., New Haven, Conn., died on May 5 in Cleveland, Ohio. He was 83 years old. Born in Akron, Ohio, Mr. Dodge first worked for the Akron Iron Co. Later he joined the Faultless Rubber Co. and was sent to Boston by the firm. He then joined Seamless Rubber and remained with the company until his retirement approximately 20 years ago.

Willard P. Smith

Willard P. Smith, retired secretary-treasurer of the Intercontinental Rubber Co., Inc., New York, N. Y., died on May 16 at his home in Fair Lawn, N. J., after a brief illness. Intercontinental Rubber was recently merged with Texas Instruments.

Expanding Natchez Plant

Plans for the expansion of the tire and tube capacity of the Natchez, Miss., plant of the Armstrong Tire & Rubber Co. by 42% have recently been announced. Armstrong has said that the program will involve $2,500,000 and will increase production capacity of tires and tubes from the present 7,000 to about 10,000 per day. Replacement of obsolete machinery with modern and more efficient equipment is one of the principal items in the expansion program.

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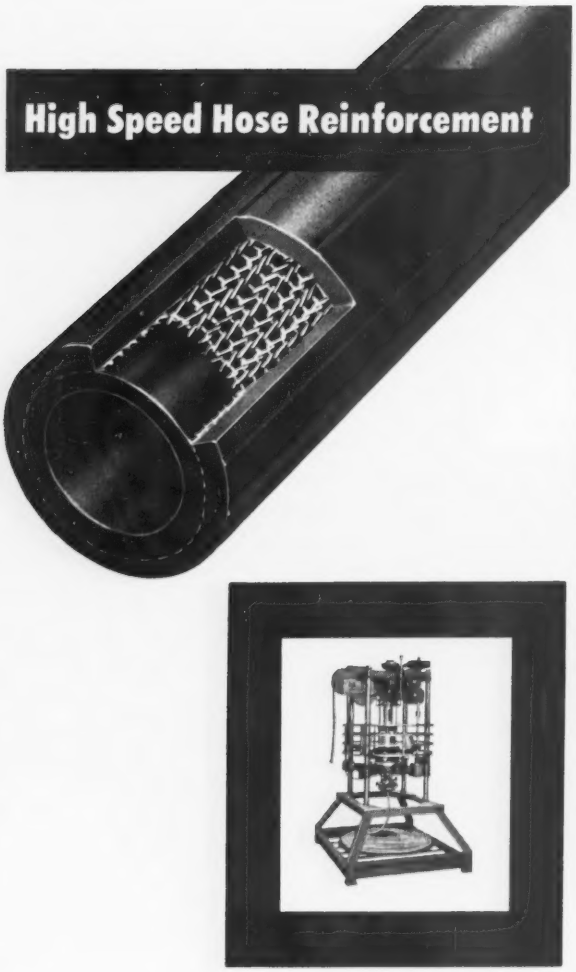

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NEW GOODS

Treated Paper Seat Covers

Swift Manufacturing Co. of Columbus, Ga., is now producing a new line of fabrics of neoprene-treated twisting paper called "Colorprene". In production, neoprene is added as a wet-strength agent to the pulp of a light (12 pound) twisting paper. Seat cover fabric is then woven from the twisted twine. Three percent neoprene, or less, the company states, is enough to produce a cover that can be sponged off, and one that won't fray or pull apart when wet. While seat cover fabric is the most recent application of neoprene treated paper, many

other uses are now being evaluated or have already been adopted commercially. As a chemically-resistant wet-strength agent, neoprene is used in laundry tag stocks, in industrial filter papers for chemical plants, and in disposable paper work caps. Because of its resistance to oil and grease, it is of interest in papers for food packaging and automotive oil filters. Swift Manufacturing is now introducing the Colorprene line to seat cover producers in a variety of colorful new patterns, one of which is shown in the photograph above.

Amazon Oil Discharge Hose

A new lightweight, flexible oil hose for use in loading and unloading tankers and barges and in other dockside operations has been developed by the U. S. Rubber Co., 1230 Avenue of the Americas, New York, N. Y. The "Amazon Oil Discharge Hose (H-1515)" uses lightweight steel nipples and is said to be one-third the weight of conventional type hoses. Although it has a working pressure of 200 pounds per square inch and a safety factor five times as great, the hose can be bent and kinked without damage and instantly springs back to shape. The company points out that the handling gear necessary for heavy hose is not required to manipulate the Amazon Oil Discharge Hose. The hose comes in sizes ranging from 3 to 12 inches inside diameter. Its neoprene tube and cover make it oil-resistant and protect against aging and sun damage, the company said.

P 17 Sealing Tape

A new water-resistant, high-strength sealing tape for cartons, paper tube ends and bundles has been announced by the Permacel Tape Corp., New Brunswick, N. J. Paper-backed and specially impregnated with a waterproof rubber resin composition, the new tape, known as "P 17," is designed to withstand extremely rough handling in shipment under both dry and wet conditions. Greater protection is afforded to merchandise because the tape will not split or tear at package closure points. The rubber type pressure-sensitive adhesive assures immediate sticking and extra tight sealing. P 17 requires no activating solvent, permitting faster and cleaner application. The extra operation of moistening tape is eliminated, as well as the danger of the solvent's damaging the contents of the package. The company states that P 17 will meet the need for protective wrapping of quality fabrics, delicate instruments and mechanisms, highly finished household merchandise, documents, etc. P 17 is available in widths of ½- to 12 inches, in ¼-inch multiples, and comes in standard 120-yard roll lengths.

Molded Foam Rubber Toys

A line of "Play-Safe" molded foam rubber toys—a football, basketball, baseball, and a baseball and bat set—has been introduced by the Advance Latex Products Co., 8590 Hays St., Culver City, Calif. Made of natural foam, the toys are washable, color-fast, non-allergic and non-toxic. Tested by a group of 100 children,

18 months to 12 years old, the line is said to have measured up to all expectations on the counts of safety and playability. The football, shown herewith, is 8 inches long and 4½ inches in diameter. The basketball is 9 inches in diameter, while the baseball has a 3½ inch diameter. The bat is 15 inches long with a 2 inch diameter ball.

New rigid Koroseal pipe, said to have the highest resistance to shock and impact known in the plastics field, has been announced by the B. F. Goodrich Company Industrial Products Division. Developed primarily for use in industrial and chemical plants, the new thermoplastic material makes available a non-metallic pipe that is tough, durable and capable of withstanding rough handling and hard usage under severe operating conditions, the company states. Rigid Koroseal pipe and fittings weigh only about a quarter as much as standard steel pipe.

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Eagle Vinyl Character Toys

A new group of vinyl character toys have been added to the line of the Eagle Rubber Co., Ashland, Ohio. An intense program of development and planning has brought about an entirely new manufacturing division devoted to the production and decoration of these colorful new squeeze toys. Design and color were reported to have been prime considerations in the development

of the toys, three of which, "Peppy Pup", "Cutie Cat", and "L'il Honey Bear" are shown herewith. The fourth toy in the group is called "Hoppity Hop". Each is produced from soft washable vinyl and decorated in cheerful pastel colors. Each is fitted with a special voice. The toys come individually packaged in polyethylene bags.

Vinyl and Rubber Flooring

Goodyear Tire & Rubber Co., Akron, Ohio, has added a number of new flooring styles to both its vinyl and rubber lines. Four new colors, including Mardi Gras Red, Coronado Coral, Glen Ayre Green, and Ivory have been added to the company's "Heavy Duty Homogeneous" vinyl line. These new colors increase the HDH flooring series to 12 colors, all in 3/32- and 1/8-inch gauges. Both gauges are available in either tile or roll goods. Goodyear has also introduced four new colors in its .080 residential vinyl line. These include Caribbean Coral, Antigua Aqua, Gala Green, and Bermuda Beige. The company's residential rubber flooring line has been increased to 10 styles by the introduction of four new colors: dark green with white; light brown with rust, cream and charcoal; blue with white, and yellow with white and brown.

Polyethylene Wastebasket

A new, giant 26-quart wastebasket for kitchen, office or about the house is being molded of Bakelite polyethylene by Loma Plastics, Inc., 3000 West Pafford St., Fort Worth, Texas. The wastebasket resists corrosion and will not mar floors or furniture. Standing 15 inches high and measuring 13½ inches in diameter at the mouth, this large wastebasket will hold a full 26 quarts. It is easily handled for cleaning in the kitchen sink. Due to polyethylene's resistance to water, oils, greases and most chemicals that tend to stain or leave odors, they can be easily and quickly washed off with soaps and detergents. The flexible, semi-rigid walls of the product make it easy to squeeze into tight storage spaces. A pouring spout can also be formed by pinching in the flexible walls. The wastebasket is available in a variety of colors.

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"Thiokol" synthetic rubber has long been recognized as the outstanding solvent resistant rubber. This property has led to its wide use in the fabrication of rubber goods that must withstand the deteriorating effects of lacquer, paint thinners, aromatic fuels, and a wide range of other solvents.

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HOSE LINER RECIPE

"Thiokol" FA	100.0
Zinc Oxide	10.0
SRF Black	60.0
Stearic Acid	0.5
B.T.D.S. (1)	0.4
D.P.G.	0.1
NA-22	0.1
Neoprene Type W Masterbatch	29.0

(1) Benzothiazyl Disulfide

Neoprene Type W Masterbatch

"Neoprene" W	100.0
E.L. Cal. Mag.	4.0
S.R.F. Black	55.0
Stearic Acid	0.5
Zinc Oxide	5.0

The Neoprene W masterbatch is added at the end of the mix and thoroughly blended with the base compound.

PHYSICAL PROPERTIES

	Original Properties	Aged 48 hours at 80° F. in SR-6 Fuel (Dried 2 hr.)		Volume Swell (24 hrs. at 80°F.)	
Cure	40'/298°F.	40'/298°F.	% Loss	Distilled Water	4%
300% Stress	1375	—	—	Ethyl Acetate	24
Tensile	1375	900	34.5	Acetone	18
Elongation	300	230	23.0	SR-6	20
Durometer	74	—	—	SR-10	4

Because of the exceptional solvent resistance of "Thiokol" type FA, small percentages of synthetic elastomers can be added as processing aids without appreciably reducing its solvent resistance.

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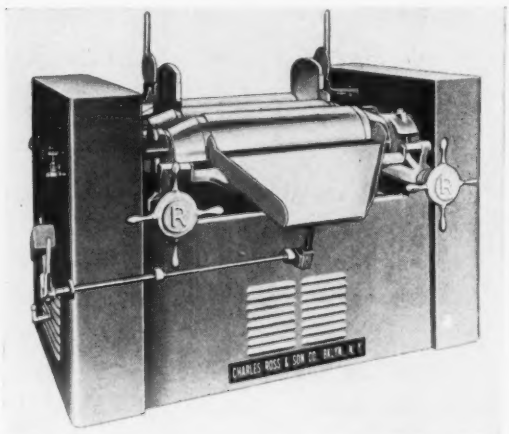
NEW EQUIPMENT

Convertible Three-Roll Mills

A new line of high-speed three-roll mills which can be readily converted for use with either fixed or floating center roll operation has been developed by Charles Ross & Son Co., of Brooklyn, N. Y. Known as Model 52TC, a three-roll mill can now be operated as a conventional mill with fixed center roll and four point adjustment, or with floating center roll and two point adjustment. When differences in pressure between feed and take-off rolls



are desired, the center roll is in fixed position. When equalized pressures are preferred, the same mill can be converted, within minutes, to have self-aligning or floating center roll. Conversion from one type of operation to the other is easily accomplished without special tools or kits, and without special skill by any operator.

The new Ross mills feature a higher ratio of differential speeds for greatest shear. In addition, the apron is adjustable for raising or lowering knife contact point or varying apron angle on the front roll. This flexibility permits the apron to be raised or lowered to the most efficient take-off position for light or heavy materials. A balanced apron provides constant uniform pressure of knife on the front roll as the knife wears. This gives continuous thorough take-off of material from the front roll and, by preventing dispersed material from cycling back into the mill, gives maximum production.

Mills having manual adjustment of rolls are provided with ball thrust bearings on adjusting screws to facilitate turning of handwheels. New, larger, calibrated indicating dials assure parallelism of roll faces with corresponding dial readings. The new mills are reported to give greater production and assure top operating efficiency when one mill must meet the various milling requirements of different materials.

The Perkin-Elmer Corp., Norwalk, Conn., is now marketing a new **die for use in making infrared analyses of solids.** According to the company, the spectrometer, with the use of the new die, not only identifies solids but gives their composition. The die features a split cone construction so that the discs can be removed without fracturing or chipping.

Model DMC Weather-Ometer

A new Weather-Ometer, known as Model DMC, has been announced by the Atlas Electric Devices Co., 361 West Superior St., Chicago 10, Ill. Accuracy in test results is said to be greatly increased in the new unit by means of a positive control of specimen temperatures. A constant volume of air at a con-

trolled temperature in the heavily insulated cabinet maintains uniform predetermined specimen temperatures regardless of variations in room conditions. Automatic control of humidities up to dew point is available as optional equipment. All automatic controls, including complete voltage controls, are located on the front panel of the Weather-Ometer, directly above the door of the test chamber. Both horizontal and vertical testing is available—cup containers for bitumens and other semi-liquid materials and vertical panels for solid materials. Source of radiation is two Atlas enclosed violet carbon arcs.

A complete line of hydraulic presses specifically built for **fiber glass molding** is now being featured by the Elmes Engineering Division, American Steel Foundries, Cincinnati 29, Ohio. The presses are made in standard capacities ranging from 50 to 300 tons and operation in each case is fully push-button controlled. Adjustable timers are provided which can be pre-set for any length of cure cycle desired.

Fisher Scientific Co., Pittsburgh 19, Penna., is currently marketing the **Warren Spectracord,** said to be the fastest recording spectrophotometer yet developed. Automatically scanning and recording the entire visible or ultraviolet spectrum in less than a minute, the new unit is reported to be 30 to 40 times faster than contemporary instruments in its price field.

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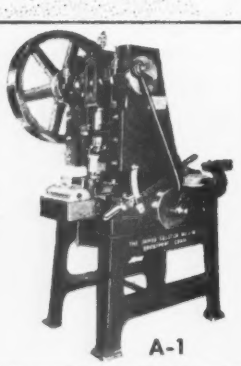

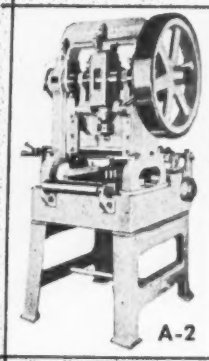

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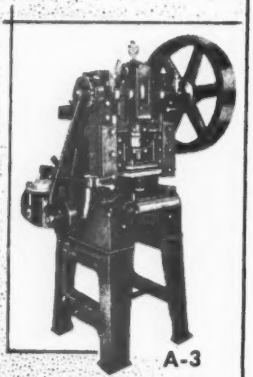

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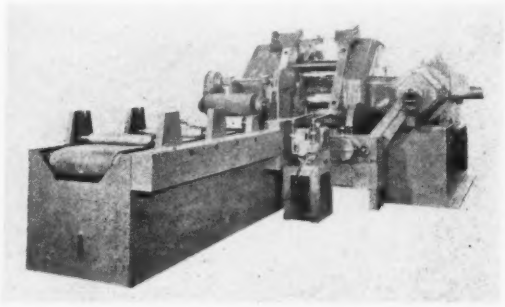
Adamson Six-Roll Laboratory Calender

A new, six-roll laboratory calender is now being offered by the Adamson United Company, Akron, Ohio, for use in experimental work on plastics, rubber and other materials. The unit is inclined at 20 degrees, with each pair of rolls inclined at 90 degrees to the previous one. This 10½ x 20-inch unit can be used for thin film



or heavy plastic sheeting. Material can be fed to the top bank or to the bottom bank, thus permitting laboratory evaluation of arc of contact on finished film. Double-coating work can be done with this calender, feeding between the third and fourth rolls. This allows each coat to be subjected to two passes before being laminated with the fabric or other material. The unit can be supplied with either anti-friction bearings or conventional sleeve bearings, lubricated in either case by means of a circulating oil system. An electronically-regulated drive provides a 10 to 1 speed range. A complete accessory train is available, as shown in the photograph, incorporating cooling, slitting, and surface-type wind-up equipment.

Null Balance Recorder-Controllers

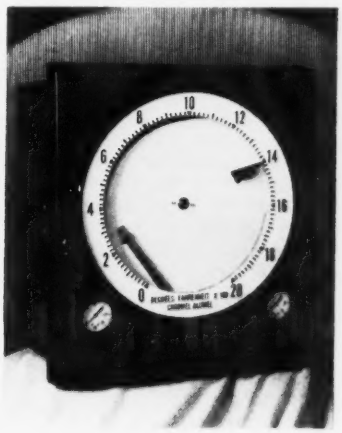
A new line of recorder-controller instruments with a wide range of industrial uses has been announced by the Fielden Instrument Division, Robertshaw-Fulton Controls Company, Philadelphia, Penna. Their applications include recording and control of temperature, conductivity, strain, force, position, pressure, and telemetering. Low first cost, low operating and maintenance costs and maximum flexibility are said to be made possible by Fielden's simplified unit assembly principle. The recorder is composed of only four readily interchangeable units. Operating on the null-balance principle using A. C. signal actuation, these instruments require no batteries or standardizing circuits.

An example of simplification is the bridge components, which are contained in a single interchangeable unit, permitting easy range changing as well as adaptation of the recorder to an entirely different measurement whenever necessary. This bridge unit is also available with up to four inputs, permitting averaging, addition or differentiation.

A range of nickel, tungsten, and platinum resistance temperature detectors is available, covering temperatures of minus 200°C. to plus 500°C. (minus 328°F. and plus 932°F.). All except the platinum bulbs feature linearized chart scales. A full range of control forms, both electric and pneumatic, is available.

G-E Line of Recording Controllers

A new line of process instruments including potentiometric and a-c bridge recorders and recording controllers has been announced by the Meter and Instrument Department, General Electric Co., Schenectady, N. Y. The instruments, designed for continuous measurement and control uninterrupted by periodic standardization, incorporate new measurement circuitry and components, according to company engineers. Foremost among the new features are a magnetic standard in the potentiometric

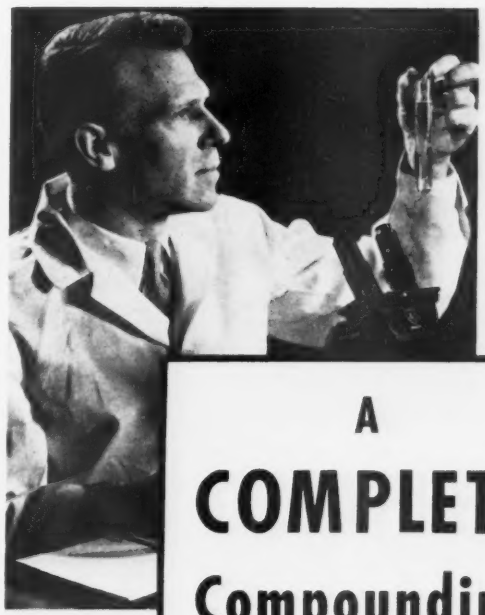


system and a bridge-balancing unit in the a-c bridge system. Both models are available with either electric or pneumatic control, and are equipped with a unique centerless pointer that simplifies chart changing and leaves practically all of the chart exposed to view for easy reading.

Heart of the a-c bridge system, the new bridge-balancing unit supplies power to the bridge and provides a means for rebalancing it. In cases where the variable under measurement is temperature, the circuit is unbalanced by changes in the resistance bulb. Balancing is achieved by a servo motor which repositions the balancing unit's rotor. Other advantages of the equipment include plug-in components, anti-backlash gearing, internal illumination, and an integral pen-inkwell assembly designed for automatic realignment.

The reinforced steel case and die-cast aluminum cover are sealed with neoprene gasketing against dirt and moisture, and can be furnished for either wall or flush mounting. Chart speeds are 1, 4, 8, 12, and 24 hours, and 7 days. Net weight of the products varies from 75 to 95 pounds, according to control form and measuring system. The units utilize a 120-volt, 60-cycle power supply. The potentiometer has a power consumption of 65 watts; the a-c bridge, 40 watts.

A new low-priced **beta radiation gage** has been developed by the Industrial Nucleonics Corp., Columbus, Ohio. Features which are said to make the new unit (Model S) unique in its price range include an electrically-operated power supply, stabilized feedback electronic amplifier, shock mountings for critical components, locked-in source with provision for alarm system, and standardization for meter span sensitivity.



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REVIEWS

BOOKS

Rubber: Natural and Synthetic. By H. J. Stern. Published by Maclaren & Sons, Ltd., Stafford House, Norfolk St., London, W.C. 2, England. 6 x 9 in. 492 pp. 75s. Od.

(Available from the Book Department, RUBBER AGE, at $12.00 per copy)

A need has long existed in the rubber field for an English-language textbook which could be utilized not only by rubber technologists themselves but by engineers in the automotive, aeronautical and other fields and by those first entering the field. Technical books on rubber are many and varied, but they either start with the assumption that the reader is fully acquainted with the chemistry of rubber or has no knowledge whatsoever of the material. The industry itself has been considerably handicapped particularly in the United States, since copies of Davis and Blake's "Chemistry and Technology of Rubber" went out of print. Accordingly, there has been a deep gap in the literature, one which is now admirably filled by this book.

The present book, although written from the British viewpoint (which was inevitable since the author is a prominent British rubber technologist), is intended primarily for those who have been trained in science or technology but, as the author puts it, "not specifically in the realm of rubber." In a sense, it is a general account of the rubber industry with descriptions of its many ramifications. The scope of the book is such that it holds appeal for the rubber manufacturer, suppliers of chemicals, machinery, and the numerous special products used in the rubber industry, engineers in general, and students of rubber who will find present-day technical procedures clearly outlined.

The scope of the book can best be grasped by the titles of its thirteen chapters, which are as follows: (1) Historical Introduction; (2) Plantation Rubber; (3) Natural Rubber—Composition, Reactions and Derivatives; (4) Properties of Vulcanized Rubber; (5) Compounding Ingredients; (6) Rubber Machinery; (7) Latex; (8) Synthetic Rubber; (9) Manufacture and Technology of Synthetic Rubbers; (10) Synthetic Rubber Latices; (11) Synthetic Resins and Plastics; (12) Manufacturing Processes; (13) Testing and Analysis. Each chapter is, of course, subdivided into various classifications, and specific references are included as footnotes to enable the reader to pursue some subjects in further detail. These reference notes, however, have been held to a minimum, and the reader is frequently placed in the position of drawing his own conclusions.

The book is actually divided into two parts, with seven chapters in the first and six in the second. Some 200 illustrations are included and it is replete with schematic drawings to enhance the text. Sources of further information are listed, and a table of metric equivalents is included.

Users of the book will find the chapter on "Manufacturing Processes" of particular interest, since certain processes, such as bonding and brass plating, are spelled out in detail. Among the complete list of rubber products covered in this chapter are balls and bulbs of all types, soles and heels, bathing caps, hot water bottles, sponge rubber goods, belting, hose, hard rubber goods, and tires. The plastics covered in the chapter on "Synthetic Resins" are those which can be handled on modified rubber machinery and equipment and which are already familiar to the rubber industry, such as polyethylene, polystyrene, polyvinyl chloride, polymethyl methacrylate, polyvinyl acetate and its derivatives, and the plastics latices in general.

In all, Dr. Stern has done remarkably well with a most difficult subject and has provided both the rubber technologist and the rubber student with a valuable manual which will serve as a reference work for some time to come. The book is a "must" for every rubber library.

BOOKLETS, CATALOGS, etc.

Witcarb Fillers for Polyester Resins. (Technical Service Bulletin W-1). Witco Chemical Co., 260 Madison Avenue, New York 16, N. Y. 8½ x 11 in. 4 pp.

Practical advantages, including the economics, of incorporating precipitated calcium carbonates as inert fillers, or extenders, in polyester resins used for molding or casting products, are detailed in this bulletin. The bulletin explains that the addition of such chemicals as the "Witcarbs" reduces resin mixture costs, imparts opacity to plastics, curtails shrinkage and crazing, assures smoother finishes, increases resin viscosity, and improves coloration. The over-all cost of reinforced plastic parts can be reduced as much as 50% without detracting from final cured properties. The bulletin identifies the extenders under discussion as Witcarbs R, P, and V, which vary in particle size, physical characteristics and cost. To facilitate selection, both their specifications and evaluations for settling and viscosity are presented.

•

Pangborn Blast Cleaning and Dust Control. (Bulletin 1210). Pangborn Corp., Hagerstown, Md. 8½ x 11 in. 24 pp.

A condensed catalog of the entire line of equipment and accessories offered by the firm, this well-illustrated publication has been provided with a special index which simplifies its use. All equipment and accessories are listed by equipment, by type, and by purpose. For example, one designation under "Purpose" is "For Fragile Castings" and the specific pieces of equipment are listed which are suitable for this particular application. The bulletin begins by discussing Rotoblast, Airblast and hydraulic methods of abrasive application and then pictures and describes the various types of equipment which make use of these three basic principles. All standard units are described as well as a limited number of the special machines which Pangborn has developed for particular problems. The wide experience in blast cleaning gained by Pangborn over the years means that many of the problems that arise in blast cleaning have already been solved by development of a special machine for a previous customer.

•

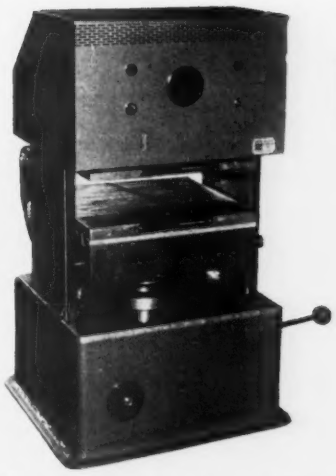
Reinforced Resinoid Grinding Wheels. (Catalog 1748). Norton Company, Worcester, Mass. 8½ x 11 in. 28 pp.

This catalog describes the company's line of reinforced Resinoid grinding wheels. Liberally illustrated, this publication contains typical application photographs, tables of wheel sizes, prices, operating speeds and other data. Scores of portable grinding operations are listed together with the recommended wheel specification. Wheels discussed in this booklet are Norton's BN type straight cutting off wheels for removing gates and risers, slotting and cutting firebrick; BD type hub wheel for weld grinding, cleaning castings, removing rust; BFR type reinforced hub wheel for work requiring flexibility for removing mold marks on castings, smoothing welds on auto bodies, preparing cast surfaces for painting and removing rust; and the BF reinforced straight wheels for deburring, removing flash from plastic parts, removing marks from turned parts, and miscellaneous light portable and bench grinding operations.

•

Koresin. Antara Chemicals Division, General Dyestuff Corp., 435 Hudson St., New York 14, N. Y. 8½ x 11 in. 12 pp.

"Koresin", a highly regarded tackifier which is a tertiary butyl phenolacetylene condensation product, is discussed in this brochure. It describes the physical properties, solubility and compatibility of Koresin and suggested uses, such as for rubber stocks, rubber cements, lacquer and varnish resin, intermediate for surface active agents, tanning agents, etc. It is stated that while Koresin is primarily a tackifier rather than a softener for GR-S, the product is generally more effective when used in conjunction with the usual softeners in rubber compounds, or as a replacement for a portion of the softeners.



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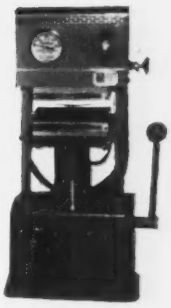

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ODP	(Iso-Octyl Iso-Decyl Phthalate)
O-16	(Iso-Octyl Palmitate)
TG-8	(Triethylene Glycol Dicaprylate)
TG-9	(Triethylene Glycol Dipelargonate)
DOP	(Di-2 Ethylhexyl Phthalate)
DOA	(Di-2 Ethylhexyl Adipate)
DIOA	(Di-Iso-Octyl Adipate)
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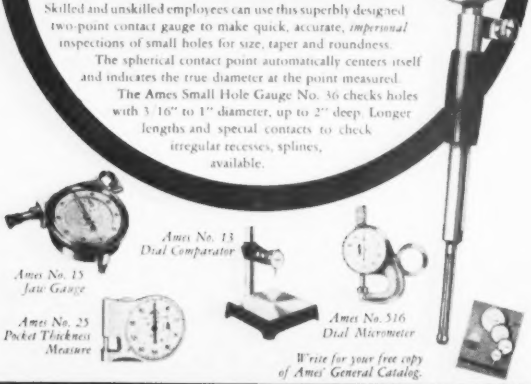

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REVIEWS (CONT'D)

Pressure Switches and Valves. (Catalog 3G). Barksdale Valves, 5125 Alcoa Ave., Los Angeles 58, Calif. 8½ x 11 in. 20 pp.

This new catalog covers pressure switches and valves produced by the company in detail. "Shear-Seal" valves for manual control of vacuum or pressures up to 6000 psi are illustrated and explained. Included are four-way, dual pressure selector, and shut-off models for pipe sizes up to 1½ inches. The second section of the catalog contains complete data on solenoid controlled "Shear-Seal" valves, selector and shut-off, for service up to 3000 psi. A chapter on 150 psi solenoid air valves has a convenient air discharge table to help in determining valve size. The most useful ranges of diaphragm, bourdon tube, and piston actuated pressure switches have been tabulated to supplement this valuable hydraulic control manual.

•

Methanol. (F-8141). Carbide and Carbon Chemicals Co., 30 East 42nd St., New York 17, N. Y. 8½ x 11 in. 16 pp.

This booklet has been prepared for people in the chemical industry: chemists, engineers, purchasing agents, and production and laboratory workers. It contains information on the uses, physical properties, shipping data, specifications, and constant-boiling mixtures of methanol. Fourteen graphs on vapor pressures, specific gravities, freezing points, viscosities, and other important physical properties of methanol, make this booklet excellent for reference. Methanol, the booklet states, has many applications in the production of rubber accelerators, adhesives, plasticizers, anti-freezes, pharmaceuticals, refrigerants, etc.

•

Five Steps to Productive Maintenance. (GEA-6087). General Electric Co., Schenectady 5, N. Y. 8½ x 11 in. 18 pp.

Detailed information on organizing to meet the demands that automation will make on an electrical maintenance program are detailed in this bulletin. The steps discussed include: (1) Gathering equipment data; (2) Determining extent of routine maintenance; (3) Establishing a routine operating control system; (4) Evaluation for critical maintenance, and (5) Establishing a critical maintenance program. Photographs and reproductions of typical record forms used in the program are provided.

•

Dodecenylsuccinic Anhydride. (Technical Bulletin 1-8). National Aniline Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y. 8½ x 11 in. 4 pp.

This bulletin should be of interest to all concerned with natural and synthetic rubbers, paints, enamels and varnishes. In addition to information on the physical and chemical properties and uses of dodecenylsuccinic anhydride, it contains two interesting graphs. The first graph is entitled "Infra-Red Absorption Spectogram" while the other deals with the effect of temperature on the viscosity of the material. A bibliography of eleven references is included.

•

Bakelite Vinyl Dispersion Resins for Organosols and Plastisols. Bakelite Co., 30 East 42nd St., New York 17, N. Y. 3¾ x 9 in. 8 pp.

Typical uses, properties and methods of applying Bakelite vinyl-resin-base organosols, plastisols and plastigels are presented in this new, illustrated booklet. It presents 15 typical applications, such as dish drainers, overshoes, anatomical models, carpets, dolls and metal chair coatings. Sales offices in principal cities are listed on the back cover of the booklet.

•

ADM Sperm Oil Products. (Technical Bulletin 904A). Chemical Products Division, Archer-Daniels-Midland Co., 2191 West 110th St., Cleveland 2, Ohio. 9 x 11 in. 18 pp.

This bulletin, prepared in handy folder form for easy filing and quick reference, covers characteristics, chemical and physical properties, and composition of twelve oils and waxes as well as solubility data. Thirty-five of the most common uses of sperm oil and sperm oil products in many industries from metalworking to textiles are included.

Powermaster Packaged Automatic Boilers. (Bulletin No. 1219). Orr & Sembower, Inc., Morgantown Road, Reading, Penna. 8½ x 11 in. 16 pp.

"Powermaster" packaged automatic boilers in seventeen sizes from 15 through 500 hp for steam process as well as steam and hot water heating service are described in this bulletin. The first portion of this bulletin describes the advantages of packaged automatic boilers contrasted with equipment of conventional design. Detailed specifications describe the boiler, burner and control systems. Typical installation photographs are reproduced emphasizing fuel savings, automatic operation, various firing arrangements, and simplified maintenance.

•

The Whys and Hows of Exporting for Manufacturers. Department of Commerce, State of New York, Albany 1, N. Y. 5½ x 9 in. 32 pp.

This booklet was prepared in order to assist manufacturers in developing export business. It endeavors to present current export practices and to emphasize the elements of this field which are of importance to a manufacturer either considering such activity or in expanding a present export business. The booklet points out major obstacles which have confronted manufacturers in the past and suggests methods of solution. A selected list of books, government documents and other sources of information is also included.

•

Plug Valve Actuators. (Bulletin 3020). Ledeen Manufacturing Co., 1600 South San Pedro St., Los Angeles 15, Calif. 8½ x 11 in. 8 pp.

This bulletin describes tandem type actuators for valves requiring relatively high torques to operate, and the new floating bar type actuators for use on valves requiring lower operating torques. The bulletin also shows actuator selection tables, typical applications, dimensions and weights, and various mountings. Many of the units described in this handsome two-color bulletin are illustrated either by photographs or by line drawings which depict their salient characteristics.

•

All-Steel Motoreducers by Falk. (Bulletin 3100). Falk Corp., 3001 West Canal St., Milwaukee 8, Wisc. 8½ x 11 in. 28 pp.

Complete information on the selection of Falk Motoreducers is contained in this bulletin, including selection tables, dimensions, weights, overhung load and thrust capacities, etc. Descriptions of standard accessories and modifications are also included as is a section on low-speed couplings. Another section of the catalog is devoted to special applications. The catalog is illustrated with cutaway and line drawings as well as photographs.

•

Air-Powered Controlled Volume Pumps. (Bulletin 1053). Milton Roy Co., 1300 East Mermaid Lane, Philadelphia 18, Penna. 8½ x 11 in. 16 pp.

This new bulletin on air-powered controlled volume pumps shows how these pumps are used to solve low-capacity flow control problems. It contains a graphic presentation of pump operating principles; capacity-pressure and air-consumption tables; examples of complete company-engineered chemical feed systems, using these units. Cutaway and line drawings as well as photographs are used to illustrate the text material.

•

Hydraulic Presses and Equipment. R. D. Wood Co., Public Ledger Building, Independence Square, Philadelphia 5, Penna. 8½ x 11 in. 12 pp.

This new brochure depicts a number of representative hydraulic presses and equipment manufactured by the company for the rubber, metalworking, plastics and woodworking industries. Printed in two colors and profusely illustrated, the publication contains basic hydraulic press specifications in addition to representative high pressure hydraulic valves, hydraulic accumulators and hydraulic shock alleviators.

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MARKETS

NEWS-PRICES

NEW YORK, JULY 6, 1954

Natural Rubber

Since our last report (June 4), the average price of spot rubber on the New York Commodity Exchange has jumped 225 points, high for the period being 24.75c reached on July 6, and low being 22.50c reached on June 7. The average price of spot rubber for the month of June was 23.01c based on 22 trading days. This compares with 21.96c in the previous month.

The trade reports that the speculator has again taken the market away from the trade. Some state that there is no question that there has been considerable merit to the advancing trend in natural rubber prices, based on the improved statistical position and particularly the increased relative rate of absorbtion in the United States.

Recent advances have been predicated on the sale of 6,000 tons of Indonesian rubber to Red China, and reports of another 12,000 tons being loaded. This follows a rumor of negotiations for the sale of 100,000 tons of Indonesian rubber to Red China in 1955.

Questionable Market Factor

Whether or not the possibility of Indonesian rubber moving to Red China is a basic factor influencing the market is questionable, many in the trade believe. It is said that the Ceylon rubber for Red China is more than sufficient for requirements in that area. If Indonesian rubber is to go to Russia via Red China the picture is not altered materially. Russia has been able to obtain many thousands of tons of rubber on licenses, if she so desired. Russian takings have been exceedingly small for months.

In view of higher prices for natural rubber, doubt has been cast over the liklihood that the statistical position for natural rubber will end the year on the favorable side. The conversion process from natural to synthetic rubber may be a slow one, but it is almost certain. The higher prices for natural rubber may also mean greater production.

The rubber trade here is reported to be disturbed over the delay in shipments of Indonesian rubber. It is estimated that at least one shipper is involved to the extent of about 2,000 tons. Estimates from London speak of deferment in shipments and possible default up to 5,000 tons. Much of this rubber had been purchased when the price was down to about 20c New York for No. 1 R.S.S.

The trade is also reported to be irritated by the poor arrivals from Indonesia in a number of instances. In such arrivals, poorer grades have been substituted for top grade estate rubber, it is said.

World production of natural rubber in May amounted to 135,000 long tons, according to estimates of the Secretariat of the International Rubber Study Group. Output in the first five months of 1954 was placed at 687,500 tons, as against 692,500 tons in the corresponding period of 1953. World consumption was estimated at 135,000 tons in May, 1954, and 702,500 tons in the first five months of 1954.

Price Data

Closing Rubber Prices on New York Commodity Exchange (No. 1 R.S.S. Contract)

FROM JUNE 5 TO JULY 6

June	Spot	July	Sept.	Dec.	Mar.	Sales
5	....	....	....	....	....	....
6	....	....	....	....	....	....
7	22.50	22.84	23.00	23.30	23.40	19
8	22.75	23.05	23.40	23.66	23.80	134
9	22.75	23.00	23.40	23.80	23.90	49
10	23.25	23.40	23.90	24.19	24.35	112
11	23.25	23.20	23.70	23.92	24.10	141
12	....	....	....	....	....	....
13	....	....	....	....	....	....
14	23.38	23.35	23.75	24.05	24.20	58
15	23.12	23.20	23.55	23.75	23.90	107
16	23.50	23.50	23.75	24.15	24.30	153
17	23.12	23.38	23.55	23.95	24.10	35
18	23.12	23.10	23.40	23.70	23.82	67
19	....	....	....	....	....	....
20	....	....	....	....	....	....
21	23.00	23.17	23.40	23.66	23.85	77
22	23.12	23.20	23.63	23.85	23.95	21
23	23.12	23.15	23.60	23.85	24.00	64
24	23.12	23.20	23.50	23.85	24.10	85
25	23.25	23.20	23.60	23.80	24.10	99
26	....	....	....	....	....	....
27	....	....	....	....	....	....
28	23.38	23.35	23.80	24.02	24.35	108
29	23.38	23.40	23.85	24.10	24.30	71
30	23.25	23.38	23.65	24.00	24.20	38
July						
1	24.12	24.10	24.59	24.85	25.10	370
2	24.50	24.60	25.00	25.30	25.65	274
3	....	....	....	....	....	....
4	....	....	....	....	....	....
5	....	....	....	....	....	....
6	24.75	25.00	25.07	25.37	25.60	192

Outside Market

No. 1 Ribbed Smoked Sheets:	
Spot	.24¾
July	.24¾
August	.24⅞
Thin Latex Crepe:	
Spot	.29½
Thin Brown Crepe, No. 2	.24⅜
Smoked Blankets	
Flat Bark Crepe	.20⅜

London Market

(Standard Smoked Sheets)

Sept.	24.95 - 25.25
Oct.-Dec.	25.10 - 25.25

Singapore Market

(Standard Smoked Sheets)

August	23.78 - 23.89

Synthetic Rubber

(Dry Types—Per Pound)

Butaprene NF	.490	- .500
Butaprene NL	.500	- .510
Butaprene NAA	.540	- .550
Butaprene NXM	.580	- .590
Chemigum 30N4NS	.500	- .510
Chemigum 50N4NS	.500	- .510
Chemigum N3	.580	- .590
G-E Silicone Rubber (compounded)	2.50	-3.60
G-E Silicone Gum (not compounded)	4.00	-4.20
GR-I	——	- .230
GR-S	——	- .230
Hycar OR-15	.580	- .590
Hycar OR-25	.500	- .510
Hycar OS-10	.550	- .560
Neoprene Types AC and CG	——	- .550
Neoprene Type GN	——	- .410
Neoprene Type GN-A	——	- .410
Neoprene Type GRT	——	- .420
Neoprene Type KNR	——	- .750
Neoprene Type Q	——	-1.00
Neoprene Type S	——	- .420
Neoprene Type W	——	- .410
Neoprene Type WRT	——	- .450
Paracril B	.500	- .510
Paracril BJ	.500	- .510
Paracril C	.580	- .590
Silastic (compounded)	1.95	- .338
Thiokol Type A	——	- .470
Thiokol Type FA	——	- .640
Thiokol PR-1	——	- .950
Thiokol Type ST	——	-1.000

Middling Upland Quotations

	June 4	July 6		
	Close	High	Low	Close
July	34.27	33.73	33.63	33.70
Oct.	34.13	34.00	33.94	33.94
Dec.	34.13	34.12	34.07	34.10

Synthetic Rubber

The RFC announcement of an advance of one cent a pound in Butyl rubber to a new price of 23c a pound, and advances of 1 to 4 cents on GR-S latices and ¼c on masterbatches came as a surprise to many in the rubber trade. While nothing was mentioned in the order about GR-S itself, the trade infers that GR-S was considered in the price adjustment, but that no action was taken.

In consideration of recent price rises for natural rubber, some quarters expect a gradual swing to synthetic. Writing on this subject in the July, 1954, issue of *Natural Rubber News*, H. C. Bugbee, president of the Natural Rubber Bureau, stated that one important element to keep in mind in trying to solve the riddle of when large scale conversions from natural to synthetic do take place is to keep abreast of technical developments in oil-extended rubber.

Oil-extended rubber is becoming an increasingly major factor in the direct competition between natural and synthetic, and the slow but steady increase in the proportion of total GR-S which represents oil-extended GR-S is of growing significance. Actual percentages for the usage of oil-extended rubber, says Mr. Bugbee, are confusing, for two reasons.

First, many of the proportions quoted are based only on the GR-S content of the oil-extended rubber vs. the quantity of GR-S which is not oil-extended. This, of course, is erroneous since for practical purposes the oil-extended rubber acts essentially as 100% polymer and the gross weight, therefore, should be considered rather than the net weight.

In the second place, in referring to percentages of extended vs. non-extended GR-S, one should actually refer to the amount of oil being used for extension. In other words, the same practical result can be obtained by the consumption of a small quantity of oil extended GR-S with a high oil content vs. a larger consumption with a smaller oil content.

Estimates 1954 Production

In 1954, oil-extended GR-S can be expected to represent about 33% of the total and the oil content will increase to an average of perhaps 35 parts per 100 parts of GR-S polymer. At the present time, it is estimated that in 1955, oil-extended GR-S will represent about 40% of the total and the formula will approach 40 parts oil.

From the natural rubber producers' standpoint, states Mr. Bugbee, there is some comfort in the fact that to date, oil-extended rubber has gained slightly more at the expense of regular GR-S than at the expense of natural. At the moment, it seems unlikely that oil-extended GR-S will compete seriously in the third of the total rubber market which seems secure for natural rubber for straight quality reasons. It is also true that technical production problems involving poor adhesion on the part of oil-extended GR-S requires more natural than straight synthetic to be used in the compounding to avoid separation in splicing and similar problems.

The strong price competition of oil-extended rubber, which sells at an average price of 17¾ to 19½c, is a point to remember in considering the question as to whether conversion from natural to synthetic takes place more readily on an upward natural rubber price rise or when the natural price declines to very attractive levels in relation to the 23c price for regular GR-S.

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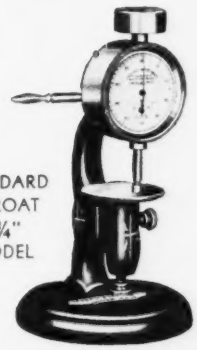

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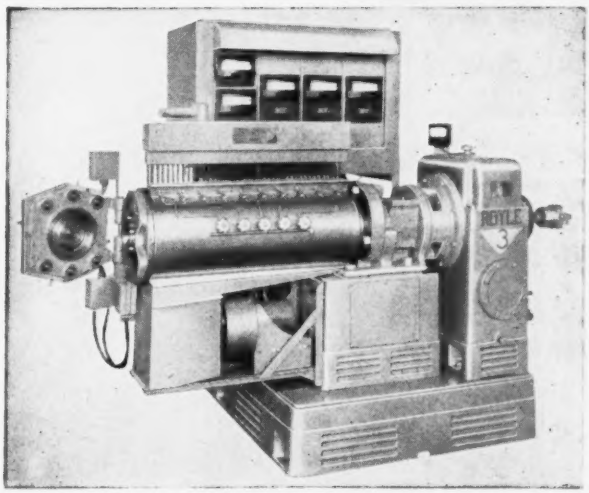

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MARKETS

NEWS-PRICES

NEW YORK, JULY 6, 1954

Reclaimed Rubber

The trade reports a fair volume of business in the reclaimed rubber market paralleling, to some extent, the rising market in natural rubber. The recently announced price rise in Butyl rubber is also expected to have a salutary effect upon the market for reclaim. Prices, during the period, have remained stable.

According to figures supplied by the U. S. Department of Commerce, the export market for reclaimed rubber is running only slightly behind the pace set in the preceding year. In the first four months of 1954, 3,569 long tons were exported. This compares with the 4,192 long tons exported in the first four months of the preceding year.

The Department also reports that stocks at the end of the first four months of 1954 stood at 31,796 long tons, about 500 long tons more than were on hand at the end of the first four months of 1953. Current prices follow:

(Prices for All Areas Except Calif.)

	per lb.
Premium Grade Whole Tire	.10½
First Line Whole Tire	.10
Second Line Whole Tire	.09½
Third Line Whole Tire	.09¼
Fourth Line Whole Tire	.08¼
Black Carcass	.14¼
No. 1 Light Colored Carcass	.20¼
No. 1 Select Peel	.11¾
No. 1 Peel	.10½
Butyl Tube Reclaim	.12½
Natural Rubber Black Tube	.15
Natural Rubber Red Tube	.21
Natural Rubber Gray Tube	.21

Scrap Rubber

Scrap rubber exports in March amounted to 2,111,379 pounds valued at $60,426, as against 2,480,408 pounds worth $55,116 in February, according to the Bureau of the Census, U. S. Department of Commerce. In January of this year, exports were 1,030,307 pounds valued at $34,211.

Quiet conditions on the scrap rubber market have continued to prevail over the past few weeks. Many consumers of scrap have either shut down or were preparing to shut down for the annual vacation periods and showed little inclination to increase their scrap inventories.

Some little activity has been noted in black passenger tubes which have been moving along, according to trade reports. However, there has been no real pressure for them on the part of consumers. Prices were nominally unchanged during the period under review. Current prices follow.

(Prices Delivered Akron)

Mixed tires	ton	13.50
Light colored carcass	lb.	.05½
No. 1 peelings	ton	48.00
No. 2 peelings	ton	30.00
No. 3 peelings	ton	24.00
Buffings	ton	18.00
Truck and Bus S.A.G.	ton	17.00
Passenger S.A.G.	ton	15.00
Natural Rubber Red Tubes	lb.	.09
Natural Rubber Black Tubes	lb.	.05½
Butyl Rubber Tubes	lb.	.02½

Tire Fabrics

According to *Textile Organon*, shipments of rayon filament yarn to the tires and related uses trade increased steadily through the second quarter of last year when 117,700,000 pounds of filament yarn went to this trade. The reduced shipments over the past nine months are presumably due, at least in part, to seasonal factors.

The fact that these seasonal influences did not make themselves apparent earlier was attributable to the shortage of producing capacity for viscose high tenacity yarn which existed until last year. Under those circumstances, the trade was taking virtually all the yarn that could be produced and cutting its consumption of cotton accordingly. Now that cotton has been almost entirely replaced by rayon and nylon in this use, obviously any decline in total demand will be reflected in rayon figures.

Exports of filament yarn last quarter at 2,100,000 pounds were somewhat larger than in October-December, 1953, but were below the quarterly averages for 1950-1953.

Lower Tire Yarn Sales

In a recent address before the New York Society of Security Analysts, Hayden B. Kline, president of the Industrial Rayon Corp., stated that while sales of viscose rayon textile yarns this year are expected to be equal to those of 1953, rayon tire yarn sales will be somewhat under last year's record high.

Mr. Kline said Industrial Rayon itself is anticipating about a 10% increase this year in its total sales, both in material and dollars. The largest part of this gain, he estimated, would be in the company's knit underwear fabric sales, for which a 15% advance is now being projected.

He said that the first quarter of this year has not been good, and it appears the second quarter will "not live up to our expectations". Mr. Kline noted that rayon tire yarn producers have curtailed their operations by 20 to 25% of rated capacity, reflecting a lower rate of automobile production. Industrial Rayon's capacity is about 90,000,000 pounds of tire yarn a year, and its textile yarn capacity is about 32,000,000 pounds.

Cites Favorable Factors

Among the favorable factors in the general outlook for the industry, Mr. Kline cited the fact that "the rising trend in the cost of doing business appears to have abated, while the rayon industry is better set now for a pickup as a result of heavy inventory reduction that has been going on for many months."

(Prices f.o.b. Shipping Point)

Rayon Tire Cord

1100	lb.	.76½
1650	lb.	.73½
2200	lb.	.73

Nylon Tire Cord

210	lb.	2.00
840	lb.	2.00

Rayon Graded Fabric

1100	lb.	.72
1650	lb.	.69½
2200	lb.	.68½

Cotton Chafers

14.4 oz. (per square yard)	lb.	.74
9.25 oz. (per square yard)	lb.	.69½
11.65 oz. (per square yard)	lb.	.66
8.9 oz. (per square yard)	lb.	.71

Liquid Latex

Natural: According to the U. S. Department of Commerce, 5,663 long tons of natural rubber latex were imported into the United States in April, making for a total of 16,759 long tons imported in the first four months of this year. In the first four months of the preceding year, 19,260 long tons were imported.

While imports in 1954 are running about 3,000 long tons behind 1953, consumption so far has been keeping pace. In the first four months of 1954, 24,160 long tons were consumed, while in the first four months of 1953, 23,993 long tons were consumed.

The Department reports that as of April 30, 1954, there were 10,787 long tons of natural rubber latex on hand, compared with the 7,428 long tons which were on hand as of April 30, 1953.

Synthetic: It is interesting to consider, at times, the trends which are being established for various commodities. Upon examination of the record, for example, it is seen that in 1951 production of GR-S latex averaged some 2,600 long tons a month. By 1952, this figure had jumped to about 3,300 long tons a month, and in 1953, monthly production was running at about 3,850 long tons. So far in 1954, average monthly production of GR-S latex is about 4,050 long tons.

As to consumption of GR-S latex, the monthly average in 1951 was approximately 2,600 tons a month. By the following year, consumption had reached an average of 3,400 tons a month. By 1953, the figure had risen to about 3,900 long tons a month. In the first four months of 1954, GR-S consumption has been running at about 3,700 long tons a month.

Cotton

The price of middling uplands on the New York Cotton Exchange has moved in the rather narrow range of 60 points since our last report (June 4), high for the period being 35.35c reached on June 7, and again on June 16 and 17, and low being 34.75c reached on June 28. The average price of middling uplands for the month of June was 35.17c based on 22 trading days. This compares with an average of 35.34c in May.

The Agriculture Department has announced that during July it will buy back about $62,000,000 worth of cotton price support loans which have been financed by banks. It is buying back certificates of interest in the loans because of heavy loan repayments by farmers to the Department's Commodity Credit Corporation.

The Department's purchases will reduce to $53,000,000 the amount of outstanding cotton certificates held by the banks. The certificates were offered to banks for financing last winter to reduce Federal money outlays. Farmers have paid off their loans in recent weeks as cash market prices exceeded the loan level.

In other reports, the Department indicated that nearly 7,200,000 bales, or 80% of the public storage stocks of cotton as of May 29, 1954, was CCC loan and pooled cotton. Data on the supply and distribution of cotton through May this season indicate that there were close to 1,100,000 bales in transit, stored on farms or in other unreported locations at the end of May.

It has also been reported that the International Cotton Advisory Committee has shelved proposals aiming at stabilization of world cotton prices along the lines of other international commodity agreements.

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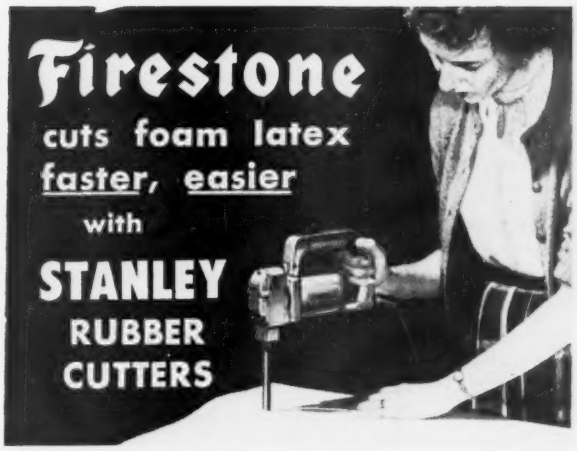

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ALCO OIL & CHEMICAL CORPORATION
TRENTON AVE. and WILLIAM ST., PHILADELPHIA 34, PA.

NEW ENGLAND OFFICE
Alco Oil & Chemical Corp.
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STATISTICS

of interest to the rubber industry

Natural Rubber in the United States

(Including Latex and Guayule)

(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1925	400,423	388,500	14,827	51,215
1926	417,643	366,200	17,671	72,510
1927	431,246	373,000	27,775	99,282
1928	439,731	437,000	32,159	65,454
1929	565,087	467,400	36,485	118,609
1930	487,628	376,000	30,205	201,000
1931	501,788	355,200	25,609	322,000
1932	414,668	336,700	20,937	379,000
1933	418,902	412,400	20,576	365,000
1934	463,018	462,500	23,856	355,000
1935	467,146	495,500	11,391	303,000
1936	488,145	575,000	12,582	223,000
1937	600,479	543,600	7,902	262,204
1938	411,983	437,031	5,652	231,500
1939	499,473	592,000	13,125	125,800
1940	818,243	648,500	7,060	288,864
1941	1,029,007	775,000	5,376	533,344
1942	282,653	376,791	10,856	422,714
1943	55,329	317,634	20,815	139,594
1944	107,834	144,113	9,665	93,650
1945	135,672	105,429	6,743	118,715
1946	400,687	277,597	4,338	237,467
1947	688,354	562,661	4,101	129,038
1948	735,227	627,332	6,673	141,541
1949	660,792	574,522	6,253	106,619
1950	802,249	720,268	8,644	89,215
1951	733,048	454,015	2,603	76,569
1952	805,997	453,846	3,624	95,260
1953	647,150	553,473	8,376	112,316
1953:				
Aug.	44,156	43,732	567	119,332
Sept.	58,625	45,225	790	121,618
Oct.	46,729	46,744	657	114,191
Nov.	49,743	43,251	1,107	113,899
Dec.	45,947	42,400	923	112,316
1954:				
Jan.	47,140	46,960	648	112,679
Feb.	42,645	46,897	638	115,228
Mar.	47,721	53,709	460	112,829
Apr.	.....	51,580	549	106,337

Source: U. S. Department of Commerce.

U. S. Imports of Natural Rubber

Year	Dry — Long Tons	Dry — Declared Value	Latex — Long Tons	Latex — Declared Value	Total Imports
1937	574,600	237,307,041	23,185	10,213,670	597,785
1938	397,640	125,373,864	11,944	4,168,127	409,584
1939	469,946	167,586,780	27,437	10,467,552	497,383
1940	781,202	303,308,823	33,789	14,593,466	814,991
1941	989,498	401,976,317	34,797	15,965,627	1,024,245
1942	266,276	112,537,426	10,646	5,630,667	276,922
1943	50,358	31,369,198	1,890	1,312,202	52,248
1944	103,847	73,908,549	3,091	2,092,211	106,938
1945	134,408	95,814,102	4,773	3,115,853	139,181
1946	376,502	228,796,110	8,421	5,843,085	384,923
1947	691,087	306,951,814	17,542	9,787,722	708,629
1948	702,293	290,849,177	32,745	18,288,233	735,038
1949	630,808	225,343,624	29,743	14,968,650	660,551
1950	747,109	416,222,598	54,401	41,764,486	801,510
1951	677,874	727,343,348	54,963	80,178,309	732,837
1952	756,987	578,179,519	48,228	40,563,116	805,215
1953	571,635	284,909,223	75,511	46,353,333	647,146
1953:					
July	47,971	22,599,799	6,691	3,845,099	54,662
Aug.	37,507	17,712,672	6,648	3,970,600	44,155
Sept.	52,498	23,968,865	6,127	3,405,762	58,625
Oct.	40,638	18,037,134	6,537	3,844,351	47,175
Nov.	44,917	20,555,812	4,826	2,621,299	49,743
Dec.	38,779	15,883,810	7,169	3,819,828	45,948
1954:					
Jan.	41,744	15,981,655	5,396	2,696,694	47,140
Feb.	36,964	14,148,159	5,681	2,931,860	42,645
Mar.	42,039	15,823,475	5,682	3,031,963	47,721

Source: Bureau of the Census, U. S. Department of Commerce.

World Production of Natural Rubber

(Including Latex)

(Long Tons)

Year	Malaya	Indonesia	Ceylon	Viet Nam & Cambodia	Latin America	Rest of World*	Total*
1942	155,000*	200,000*	101,500	76,177	35,794	71,476	640,000
1943	75,000*	100,000*	105,500	70,370	41,900	72,507	465,000
1944	25,000*	50,000*	98,500	60,419	49,946	77,002	360,000
1945	8,600*	10,000*	97,500	12,000*	47,125	73,570	250,000
1946	403,719	175,000*	94,000	19,975	39,678*	105,080	837,500
1947	646,362	277,951	89,000	38,128	34,928*	172,792	1,260,000
1948	698,189	432,349	95,000	43,935	29,158*	226,056	1,525,000
1949	671,503	432,996	89,500	43,010	27,318*	225,907	1,490,000
1950	694,090	696,472	113,500	48,482	26,902*	279,541	1,860,000
1951	605,346	814,406	105,000	52,136	29,777*	277,716	1,885,000
1952	584,828	749,241	96,500	63,134	35,475*	260,111	1,790,000
1953	574,390	691,998	97,000	74,545	35,318*	249,644	1,722,500
1953:							
Aug.	51,141	58,709	9,500	6,819	2,249*	17,618	145,000
Sept.	47,452	59,156	8,500	6,448	2,623*	19,669	145,000
Oct.	49,383	53,841	7,500	7,641	3,026*	21,296	142,500
Nov.	48,393	50,885	8,000	8,520	3,097*	21,368	142,500
Dec.	52,600	64,232	14,500	10,561	2,932*	23,125	167,500
1954:							
Jan.	49,424	59,092	10,008	7,958	3,617*	22,717	152,500
Feb.	43,366	53,276	6,333	....	2,491*	20,246	127,500
Mar.	42,130	59,881	4,540	....	600*	2,844	137,500

Source: International Rubber Study Group. * Estimated.

World Consumption of Natural and Synthetic Rubber

(Including Latex)

(Long Tons)

Year	United States	United Kingdom	Canada	Europe*	Rest of World*	Total*
1943	488,525	66,730	32,896	150,000	156,104	907,500
1944	710,783	86,977	34,310	132,500	160,690	1,125,000
1945	799,009	91,047	41,836	87,500	108,164	1,127,500
1946	1,039,296	126,770	39,196	145,000	115,804	1,467,500
1947	1,122,327	156,399	61,452	242,500	153,548	1,735,000
1948	1,069,404	196,286	62,121	392,000	182,379	1,902,500
1949	988,903	186,622	56,362	446,500	207,388	1,887,500
1950	1,258,557	222,425	68,695	448,500	287,055	2,285,000
1951	1,214,298	238,101	70,809	476,500	314,941	2,312,500
1952	1,261,413	202,179	67,099	550,000	254,901	2,335,000
1953	1,335,559	211,453	73,394	519,750	341,356	2,482,500
1953:						
July	105,228	17,190	5,506	39,000	26,244	192,500
Aug.	102,973	14,550	4,694	33,500	26,056	182,500
Sept.	103,877	18,210	5,904	41,500	34,846	205,000
Oct.	105,259	21,838	6,095	42,750	28,905	205,000
Nov.	95,921	20,621	6,237	55,500	29,513	207,500
Dec.	93,302	17,411	6,127	40,250	29,623	187,500
1954:						
Jan.	97,133	20,862	5,642	40,500	31,608	195,000
Feb.	95,957	17,985	6,563	40,750	24,437	185,000
Mar.	109,039	19,796	6,517	.....	26,983	202,500

Source: International Rubber Study Group. * Estimated.

U. S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.

(All Quantities in Long Tons)

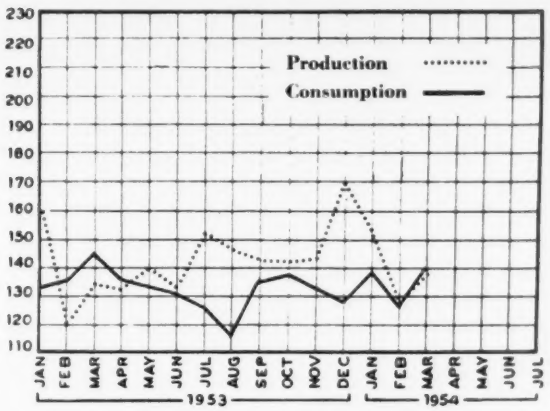
Year	Balata — Tons	Balata — Value	Jelutong — Tons	Jelutong — Value	Gutta-Percha & Other Guttas — Tons	Gutta-Percha & Other Guttas — Value
1943	1,047	708,701	35	14,840	....	.....
1944	1,012	660,805	88	45,578	10	4,999
1945	1,361	907,253	....	.....	36	21,970
1946	2,281	2,233,065	304	256,169	423	458,064
1947	1,982	2,276,531	2,878	1,496,887	392	779,591
1948	1,195	805,078	3,401	2,377,765	423	542,788
1949	1,391	814,554	1,043	834,978	197	189,021
1950	2,117	1,589,885	1,789	1,515,162	541	745,418
1951	2,452	1,973,271	1,669	2,608,359	383	430,539
1952	988	762,994	1,636	2,094,983	282	385,890
1953	1,619	866,248	1,027	1,166,837	235	303,116
1953:						
June	106	56,457	90	93,063	16	16,565
July	160	79,349	66	59,003	40	48,868
Aug.	124	75,627	96	103,480	7	13,743
Sept.	133	59,783	77	105,542	21	41,681
Oct.	50	23,033	101	110,166	10	18,363
Nov.	107	56,544	73	77,496	19	31,834
Dec.	342	148,582	56	55,136	60	33,175
1954:						
Jan.	61	30,769	74	60,746	9	23,425
Feb.	44	18,583	98	88,964	33	28,464
Mar.	19	22,053	59	73,541	19	17,213

Source: U. S. Department of Commerce.

STATISTICS at a glance

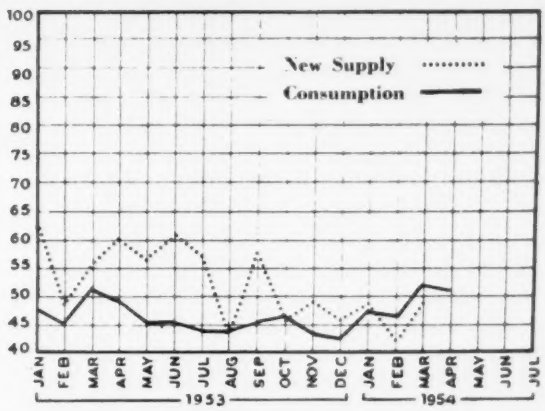
NATURAL RUBBER—WORLD

(thousands of long tons)



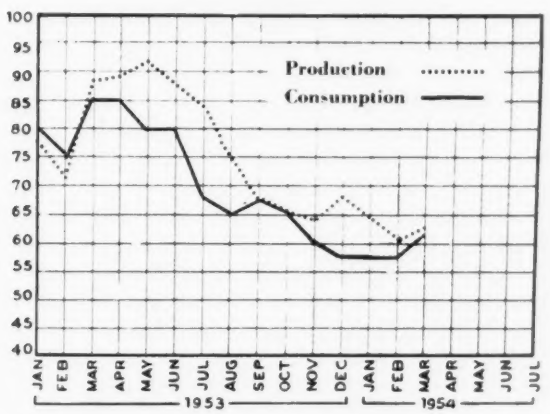
NATURAL RUBBER—UNITED STATES

(thousands of long tons)



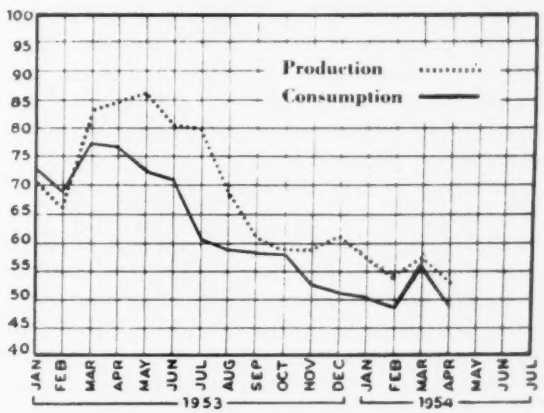
SYNTHETIC RUBBER—WORLD

(thousands of long tons)



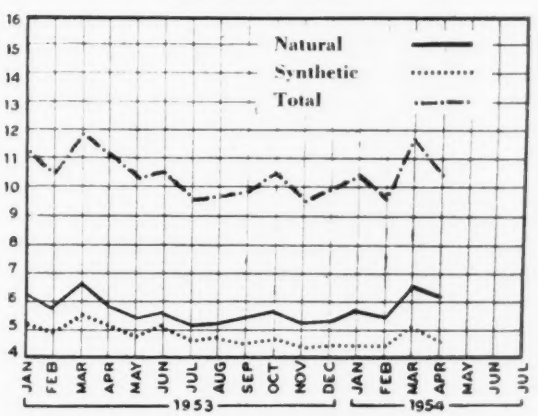
SYNTHETIC RUBBER—UNITED STATES

(thousands of long tons)



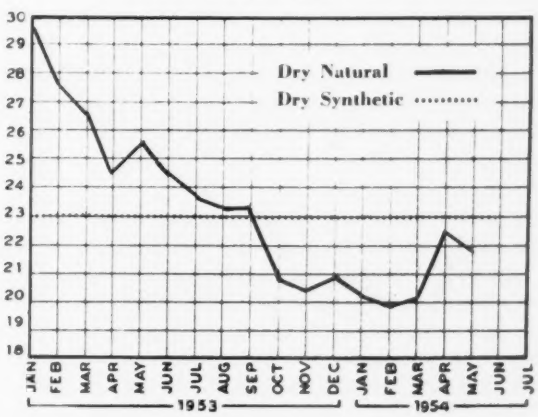
LATEX CONSUMPTION IN THE U. S.

(thousands of long tons)



PRICES—NATURAL AND SYNTHETIC

(cents per pound)



Synthetic Rubber in the United States

(All Quantities in Long Tons)

New Supply

Year	GR-S	Neoprene	Butyl	N-Type	Total
1945	724,859	45,672	52,378	7,871	830,780
1946	613,408	47,766	80,823	5,738	747,735
1947	408,858	31,495	62,824	6,618	509,795
1948	405,492	34,848	56,662	7,012	504,014
1949	310,539	35,215	54,046	11,072	410,932
1950	378,887	50,067	60,915	12,037	501,906
1951	704,529	58,907	76,475	15,333	855,244
1952	654,854	65,745	81,630	16,228	818,447
1953	680,728	80,495	79,801	20,198	861,222
1953:					
Aug.	53,411	6,610	7,202	1,646	69,177
Sept.	45,969	6,943	6,771	2,062	61,745
Oct.	42,147	6,784	6,736	2,300	57,967
Nov.	43,020	7,137	6,036	1,777	57,970
Dec.	45,902	6,990	6,057	1,459	60,408
1954:					
Jan.	44,377	6,513	5,539	1,620	58,049
Feb.	41,691	6,206	4,801	1,574	54,272
Mar.	44,464	5,190	5,214	1,900	56,768
Apr.	35,384	5,601	6,004	1,645	48,634

Consumption

1945	600,145	42,394	43,012	8,029	693,580
1946	632,126	44,357	79,228	5,988	761,699
1947	448,589	37,703	68,838	4,536	559,666
1948	345,313	32,118	58,870	5,771	442,072
1949	299,420	31,753	50,855	8,827	414,381
1950	416,230	43,781	66,348	11,930	538,289
1951	626,444	48,887	70,500	13,066	758,897
1952	666,420	55,522	71,229	13,866	807,037
1953	624,181	65,900	77,826	16,929	784,836
1953:					
Aug.	47,018	5,357	5,551	1,315	59,372
Sept.	46,267	5,407	5,587	1,391	58,652
Oct.	46,150	5,443	5,506	1,416	58,515
Nov.	41,604	4,911	4,919	1,236	52,670
Dec.	40,018	4,836	4,808	1,240	50,902
1954:					
Jan.	38,689	4,774	5,438	1,272	50,173
Feb.	37,707	4,467	5,696	1,190	49,060
Mar.	43,136	5,177	6,300	1,447	56,060
Apr.	41,230	4,465	6,204	1,274	53,173

Exports

1945	76,555	5,837	980	406	83,778
1946	68,763	2,642	495	797	72,697
1947	7,951	2,617	62	755	11,385
1948	1,093	2,875	21	885	4,874
1949	1,401	3,330	178	1,574	6,483
1950	900	4,826	31	1,895	7,652
1951	483	6,825	216	1,725	9,249
1952	9,467	9,813	126	2,695	22,101
1953	7,692	11,494	237	3,245	22,668
1953:					
Aug.	820	895	3	257	1,840
Sept.	702	1,065	0	456	2,223
Oct.	455	915	4	303	1,677
Nov.	729	1,155	11	409	2,304
Dec.	791	1,416	6	414	2,627
1954:					
Jan.	618	434	0	295	1,347
Feb.	508	1,251	2	287	2,048
Mar.	1,265	930	416	288	2,899
Apr.	887	1,091	209	288	2,475

Stocks

1945	170,571	9,703	18,378	4,802	203,454
1946	81,483	10,470	19,478	3,755	115,186
1947	40,606	5,237	13,184	3,339	62,366
1948	96,282	5,072	10,995	2,762	115,111
1949	77,731	4,654	12,224	3,433	98,042
1950	36,942	5,733	7,243	2,840	52,758
1951	105,271	8,379	12,481	3,821	129,912
1952	83,861	8,535	22,716	3,875	118,987
1953	135,153	11,480	24,866	4,346	175,845
1953:					
Aug.	134,936	10,008	20,269	3,939	169,153
Sept.	132,453	9,671	21,280	4,221	167,625
Oct.	129,655	10,138	22,435	4,496	166,724
Nov.	127,464	11,067	23,401	4,591	166,523
Dec.	135,153	11,480	24,866	4,346	175,845
1954:					
Jan.	138,692	13,065	24,733	4,349	180,839
Feb.	143,202	12,518	23,573	4,112	183,405
Mar.	145,178	12,575	22,329	4,202	184,284
Apr.	136,511	12,991	21,549	4,293	175,344

Source: U. S. Department of Commerce.

Natural and Synthetic Rubber Latex in the United States

(All Quantities in Long Tons)

New Supply

Year	Natural	GR-S	Neoprene	N-Type	Total Synthetic	Grand Total
1942	9,595	.....	210	.....	210	9,805
1943	1,890	194	1,512	.....	1,706	3,596
1944	3,090	6,580	4,683	.....	11,263	14,353
1945	4,768	15,176	7,077	.....	22,253	27,021
1946	8,012	24,810	13,595	.....	38,405	46,417
1947	17,675	22,474	6,089	.....	28,563	46,238
1948	32,630	21,494	5,022	.....	26,516	59,146
1949	29,974	21,357	3,651	.....	25,008	54,982
1950	54,401	31,339	5,725	.....	37,064	91,465
1951	54,963	32,972	6,866	2,948	42,786	97,749
1952	48,228	42,273	7,598	4,164	54,035	102,263
1953	75,511	48,112	9,026	5,844	62,982	138,493
1953:						
Apr.	6,302	4,472	879	429	5,780	12,082
May	5,548	4,784	721	439	5,944	11,492
June	6,403	4,331	739	425	5,495	11,898
July	6,691	3,997	571	466	5,034	11,725
Aug.	6,649	3,149	753	633	4,535	11,184
Sept.	6,127	3,518	778	582	4,878	11,005
Oct.	6,537	3,654	753	733	5,140	11,677
Nov.	4,826	3,715	754	352	4,821	9,647
Dec.	7,168	3,900	636	490	5,026	17,220
1954:						
Jan.	5,396	4,089	592	471	5,152	10,548
Feb.	5,681	3,928	742	375	5,045	10,726
Mar.	5,682	4,142	709	483	5,334	9,476
Apr.	.....	4,046	803	461	5,310	.....

Consumption[1]

1942	9,392	.....	200	....	200	9,592
1943	9,578	150	1,400	....	1,550	11,128
1944	6,085	6,000	4,400	....	10,400	16,485
1945	3,886	14,500	6,800	....	21,300	25,186
1946	5,714	23,500	13,000	....	36,500	42,214
1947	13,909	22,500	6,500	....	29,000	42,909
1948	28,489	21,500	5,250	....	26,750	55,239
1949	36,117	21,500	3,750	....	25,250	61,367
1950	56,138	31,000	5,500	...	36,500	92,638
1951	46,750	31,031	6,279	2,628	39,938	86,688
1952	53,567	40,562	7,368	3,093	51,023	104,590
1953	67,375	46,473	7,981	3,654	58,108	125,483
1953:						
Apr.	5,937	4,172	764	341	5,277	11,214
May	5,395	4,008	643	310	4,961	10,356
June	5,654	3,950	704	358	5,012	10,666
July	5,100	3,750	554	298	4,602	9,702
Aug.	5,203	3,576	670	343	4,641	9,832
Sept.	5,504	3,599	678	166	4,443	9,947
Oct.	5,897	3,719	660	312	4,563	10,460
Nov.	5,234	3,510	553	244	4,307	9,541
Dec.	5,395	3,475	574	277	4,344	14,065
1954:						
Jan.	5,882	3,475	615	275	4,365	10,247
Feb.	5,595	3,568	575	250	4,393	9,988
Mar.	6,610	3,982	729	335	5,046	11,656
Apr.	6,073	3,717	513	298	4,528	10,601

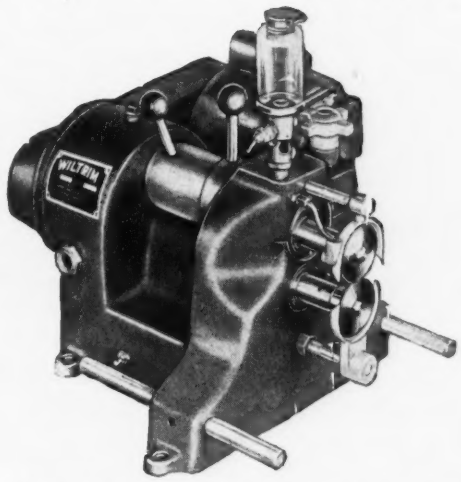
Stocks at End of Period

1942	13,450	....	....	....	....	13,450
1943	5,638	....	....	....	....	5,638
1944	2,443	....	....	....	....	2,443
1945	3,121	....	....	....	....	3,121
1946	4,865	....	....	....	....	4,865
1947	5,033	....	....	....	....	5,033
1948	11,235	....	....	....	....	11,235
1949	5,063	....	....	....	....	5,063
1950	4,927	....	....	....	....	4,927
1951	4,752	3,727	1,245	532	5,504	10,256
1952	6,201	5,040	1,019	902	6,961	13,162
1953	13,532	4,794	1,117	721	6,632	20,164
1953:						
Apr.	7,428	4,815	1,233	833	6,881	14,309
May	7,648	5,254	1,163	715	7,132	14,780
June	8,094	5,744	1,069	593	7,406	15,500
July	9,256	5,861	1,162	514	7,537	16,793
Aug.	10,273	5,081	1,127	617	6,946	17,992
Sept.	11,370	4,794	1,122	638	6,554	17,924
Oct.	11,126	4,990	1,133	737	6,860	17,986
Nov.	10,834	4,533	1,064	743	6,340	17,174
Dec.	13,532	4,794	1,117	721	6,632	20,164
1954:						
Jan.	12,375	5,001	1,019	703	6,723	19,098
Feb.	12,963	5,269	963	625	6,857	19,820
Mar.	11,870	5,247	975	588	6,810	18,680
Apr.	10,787	5,359	1,045	580	6,984	17,771

Source: U. S. Department of Commerce.
Note: (1) GR-S and Neoprene consumption estimated through 1950.

WILTRIM®

Model DF TRIMMER



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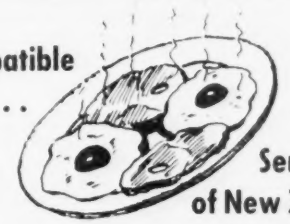

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NORWOOD, MASSACHUSETTS

Rubber Industry Employment Earnings and Hours

All Rubber Products

Mo.	1953 Production Workers (thousands)	1953 Average Weekly Earnings	1953 Average Weekly Hours	1953 Average Hourly Earnings	1954 Production Workers (thousands)	1954 Average Weekly Earnings	1954 Average Weekly Hours	1954 Average Hourly Earnings
Jan.	219.2	$78.09	41.1	$1.90	205.7	75.08	38.7	1.94
Feb.	219.2	79.30	41.3	1.92	202.9	75.47	38.9	1.94
Mar.	220.5	80.29	41.6	1.93	199.9	74.31	38.5	1.93
Apr.	226.3	79.32	41.1	1.93	198.1	....	....	....
May	226.2	78.59	40.3	1.95	....	....	....	....
June	226.5	78.55	40.7	1.93	....	....	....	....
July	219.3	78.98	40.5	1.95	....	....	....	....
Aug.	220.7	77.21	39.8	1.94	....	....	....	....
Sept.	220.6	74.88	39.0	1.92	....	....	....	....
Oct.	215.6	75.07	39.1	1.92	....	....	....	....
Nov.	210.0	75.65	39.4	1.92	....	....	....	....
Dec.	208.7	75.66	39.2	1.93	....	....	....	....

Tires and Tubes

Jan.	91.5	89.24	40.2	2.22	86.4	82.88	37.5	2.21
Feb.	91.2	91.80	40.8	2.25	85.3	83.03	37.4	2.22
Mar.	91.6	93.83	41.7	2.25	85.1	81.33	36.8	2.21
Apr.	95.6	91.58	40.7	2.25	....	....	....	....
May	96.2	91.30	40.4	2.26	....	....	....	....
June	96.0	89.20	40.0	2.23	....	....	....	....
July	93.7	90.45	40.2	2.25	....	....	....	....
Aug.	93.3	87.58	39.1	2.24	....	....	....	....
Sept.	93.4	83.54	37.8	2.21	....	....	....	....
Oct.	90.3	83.16	37.8	2.20	....	....	....	....
Nov.	87.3	85.09	38.5	2.21	....	....	....	....
Dec.	86.7	82.43	37.3	2.21	....	....	....	....

Rubber Footwear

Jan.	24.5	64.96	40.1	1.62	21.5	62.98	38.4	1.64
Feb.	24.2	67.57	41.2	1.64	20.5	65.57	39.5	1.66
Mar.	24.2	67.57	41.2	1.64	19.4	65.51	39.7	1.65
Apr.	23.8	67.82	41.1	1.65	....	....	....	....
May	23.3	60.31	37.0	1.63	....	....	....	....
June	23.5	68.06	41.0	1.66	....	....	....	....
July	22.5	68.64	41.1	1.67	....	....	....	....
Aug.	23.6	65.53	40.2	1.63	....	....	....	....
Sept.	24.1	64.24	39.9	1.61	....	....	....	....
Oct.	24.0	62.86	38.8	1.62	....	....	....	....
Nov.	23.7	63.57	39.0	1.63	....	....	....	....
Dec.	22.9	65.44	39.9	1.64	....	....	....	....

All Other Rubber Products

Jan.	103.2	71.74	42.2	1.70	97.8	70.62	39.9	1.77
Feb.	103.8	71.06	41.8	1.70	97.1	70.40	40.0	1.76
Mar.	104.7	71.72	41.7	1.72	95.4	69.48	39.7	1.75
Apr.	106.9	71.21	41.4	1.72	....	....	....	....
May	106.7	70.93	41.0	1.73	....	....	....	....
June	107.0	71.28	41.2	1.73	....	....	....	....
July	103.1	70.64	40.6	1.74	....	....	....	....
Aug.	103.8	70.30	40.4	1.74	....	....	....	....
Sept.	103.1	69.65	39.8	1.75	....	....	....	....
Oct.	101.3	70.70	40.4	1.75	....	....	....	....
Nov.	99.0	70.53	40.3	1.75	....	....	....	....
Dec.	99.1	72.45	40.7	1.78	....	....	....	....

Source: U. S. Department of Labor.

Note: Data are based upon reports from cooperating establishments covering both full and part-time employees who work during, or received pay for, any part of the pay period ending nearest the 15th of the month. These employment series have been adjusted to first quarter 1951 benchmark levels indicated by data from government social insurance programs. Hours and earnings data pertain only to production and related workers.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1947	1948	1949	1950	1951	1952	1953	1954
Jan.	32.58	36.09	33.37	31.89	45.04	42.96	33.24	34.15
Feb.	33.91	33.63	33.41	32.79	(a)	41.64	33.76	35.00
Mar.	35.89	35.04	33.44	32.65	46.06	41.70	34.10	35.23
Apr.	35.89	38.10	33.84	33.23	46.06	41.79	33.85	35.22
May	36.51	38.57	33.73	33.64	46.06	39.68	34.30	35.34
June	37.83	38.12	33.56	34.61	46.06	41.31	34.11	35.17
July	38.03	34.89	32.99	38.11	4 .21	40.37	34.20	....
Aug.	34.83	32.23	32.06	38.93	35.93	40.42	33.82	....
Sept.	32.21	31.92	30.94	41.62	36.20	39.75	33.69	....
Oct.	32.39	32.01	30.32	40.66	38.13	37 52	33.53	....
Nov.	34.50	32.15	30.52	43.11	42.70	35.59	33.60	....
Dec.	36.74	32.90	31.08	42.37	43.32	33.76	33.52	....
Average for Year	35.11	34.64	32.44	37.05	42.43	39.71	33.81	....

Note: The Government established a ceiling price of 45.76c for spot cotton on March 3, 1951. (a) Trading suspended during February.

Production Index for the Rubber Industry

(1947-1949 = 100)

(Based on man-hours)

	1952	1953	1954		1952	1953	1954
Jan.	116	132	114	July	92	114	....
Feb.	119	140	114	Aug.	109	122	....
Mar.	120	143	118	Sept.	118	122	....
Apr.	114	140	115	Oct.	131	127	....
May	111	137	....	Nov.	129	120	....
June	115	131	....	Dec.	123	111	....

Sales by the Rubber Industry

(in Millions of Dollars*)

	1952	1953	1954		1952	1953	1954
Jan.	408	424	348	July	377	448	....
Feb.	402	435	351	Aug.	388	409	....
Mar.	400	473	388	Sept.	427	416	....
Apr.	407	444	....	Oct.	423	395	....
May	402	422	....	Nov.	383	346	....
June	409	436	....	Dec.	418	369	....

Rubber Manufacturers' Inventories

(in Millions of Dollars*)

	1952	1953	1954		1952	1953	1954
Jan.	809	866	844	July	890	925	....
Feb.	842	868	857	Aug.	877	897	....
Mar.	857	880	849	Sept.	871	908	....
Apr.	850	874	....	Oct.	866	881	....
May	855	888	....	Nov.	850	867	....
June	851	914	....	Dec.	877	868	....

Source: U. S. Department of Commerce.
Notes: * Adjusted for seasonal variation.

No. 1 R.S.S.—Annual Average Prices

(New York Market—Cents per Pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1912	140	108	121.60	1933	9⅞	2⅞	5.96
1913	113	59	82.04	1934	15⅞	8¾	12.92
1914	93	56	65.33	1935	13¾	10½	12.37
1915	79	58½	65.85	1936	23	13½	16.41
1916	102	55	72.50	1937	26⅞	14	19.39
1917	90	52	72.23	1938	17⅞	10¼	14.64
1918	70	40	60.15	1939	24	14⅛	17.57
1919	57	38½	48.70	1940	24	18¼	20.10
1920	56½	16	36.30	1941	24⅞	19⅛	22.40
1921	21¼	11½	16.36	1942	22½	22½	22.50
1922	28⅜	13⅝	17.50	1943	22½	22½	22.50
1923	37⅛	24¾	29.45	1944	22½	22½	22.50
1924	40⅜	17⅝	26.20	1945	22½	22½	22.50
1925	121	34⅜	72.46	1946	22½	22½	22.50
1926	88½	36¾	48.50	1947	25	14	20.00
1927	41¾	33	37.72	1948	25	18	21.99
1928	41¼	17	22.48	1949	19¾	15⅞	17.57
1929	26⅞	15½	20.55	1950	86	18	41.10
1930	16½	7½	11.98	1951	76	52	(a)
1931	8⅝	4¼	6.17	1952*	33	26½	29.15
1932	4¾	2½	3.49	1953	31⅞	19⅞	24.21

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses. Free trading was resumed May 1, 1947. (a) Free trading suspended March 31, 1951. GSA selling price ranged between 52 and 66c during balance of year. * Free trading was resumed on July 1, 1952; figures represent only July through December, 1952.

No. 1 R.S.S.—Monthly Average Prices

(New York Market—Cents per pound)

	1947	1948	1949	1950	1951	1952	1953	1954
Jan.	22.50 (b)	21.83	19.23	18.33	71.21	....	29.40	20.22
Feb.	25.75 (b)	20.42	18.49	19.40	73.61	....	27.57	19.98
Mar.	25.75 (b)	20.33	19.08	19.86	72.05	....	26.59	20.16
Apr.	25.75 (b)	22.87	18.53	23.51	....	....	24.66	22.06
May	21.04	23.39	17.92	28.07	....	....	25.52	21.96
June	16.29	22.80	16.36	30.92	....	....	24.42	23.01
July	15.48	24.24	16.45	39.10	....	30.52	23.64	....
Aug.	15.23	23.63	16.60	51.63	....	29.36	23.36	....
Sept.	16.55	22.81	17.58	55.98	....	27.42	23.06	....
Oct.	20.38	22.13	16.31	62.19	....	27.06	20.82	....
Nov.	23.57	20.52	16.70	73.05	....	29.25	20.58	....
Dec.	21.45	18.86	17.53	71.20	....	31.26	20.92	....
Average for Year	20.00	21.99	17.57	41.10	(a)	29.15	24.21	....

Notes: (a) Free trading suspended March 31, 1951, and resumed on July 1, 1952. (b) Price fixed by Government.

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Automotive Pneumatic Casings

(Thousands of Units)

	Shipments				Production	Inventory End of Period
	Original Equipment	Replacement	Export	Total		
1943 (total)	6,128	18,547	225	24,900	20,423	1,883
Passenger Car.	82	10,606	71	10,759	7,620	1,132
Truck and Bus	6,046	7,941	154	14,141	12,803	751
1944 (total)	6,654	26,439	263	33,356	33,446	2,013
Passenger Car.	208	18,330	130	18,668	18,819	1,218
Truck and Bus	6,446	8,109	133	14,688	14,627	795
1945 (total)	5,984	36,479	504	42,967	44,524	3,077
Passenger Car.	1,115	25,463	222	26,800	28,200	2,214
Truck and Bus	4,869	11,016	282	16,167	16,324	863
1946 (total)	15,310	65,490	1,512	82,312	82,298	2,448
Passenger Car.	11,086	54,684	653	66,423	66,466	1,763
Truck and Bus	4,224	10,806	859	15,889	15,832	685
1947 (total)	25,056	62,871	3,256	91,183	95,550	6,949
Passenger Car.	19,644	52,857	1,608	74,109	77,795	5,444
Truck and Bus	5,412	10,014	1,648	17,074	17,755	1,505
1948 (total)	26,845	49,148	1,787	77,781	81,314	10,698
Passenger Car.	21,589	41,295	656	63,540	66,738	8,773
Truck and Bus	5,256	7,853	1,132	14,241	14,576	1,925
1949 (total)	31,584	43,466	1,467	76,517	76,369	10,638
Passenger Car.	28,129	36,440	509	65,077	65,140	8,904
Truck and Bus	3,456	7,026	958	11,440	11,228	1,734
1950 (total)	41,349	56,808	1,430	99,587	92,754	3,794
Passenger Car	36,678	47,103	642	84,423	78,598	3,050
Truck and Bus	4,671	9,705	788	15,164	14,156	743
1951 (total)	32,153	44,612	1,677	78,442	83,405	8,765
Passenger Car	26,729	34,226	723	61,678	65,546	6,973
Truck and Bus	5,424	10,386	954	16,764	17,859	1,791
1952 (total)	29,484	54,342	1,520	85,346	90,411	14,110
Passenger Car.	24,106	45,458	741	70,305	74,341	11,251
Truck and Bus	5,378	8,884	779	15,041	16,070	2,859
1953 (total)	37,949	55,124	1,543	94,617	96,150	15,720
Passenger Car.	33,106	45,798	809	79,713	81,455	13,044
Truck and Bus	4,843	9,326	734	14,904	14,696	2,676
1953:						
June (total)	3,537	5,601	142	9,279	8,572	16,259
Passenger Car.	3,216	4,819	75	8,111	7,311	12,852
Truck and Bus	320	782	66	1,168	1,261	3,406
July (total)	3,616	5,793	146	9,555	8,173	14,883
Passenger Car.	3,181	4,953	99	8,232	7,119	11,736
Truck and Bus	435	840	48	1,323	1,061	3,147
Aug. (total)	3,130	5,523	145	8,798	7,416	13,550
Passenger Car.	2,757	4,649	87	7,493	6,406	10,684
Truck and Bus	372	874	58	1,304	1,010	2,866
Sept. (total) ..	2,837	4,437	149	7,424	7,148	13,287
Passenger Car.	2,503	3,691	84	6,278	6,082	10,494
Truck and Bus	334	747	65	1,146	1,067	2,793
Oct. (total)	3,155	4,246	172	7,573	7,664	13,446
Passenger Car.	2,832	3,212	90	6,135	6,529	10,941
Truck and Bus	323	1,034	82	1,438	1,135	2,505
Nov. (total)	2,221	2,730	135	5,085	6,565	14,852
Passenger Car.	1,875	2,185	75	4,134	5,531	12,284
Truck and Bus	346	545	60	951	1,034	2,568
Dec. (total)	2,620	2,903	143	5,667	6,481	15,720
Passenger Car.	2,263	2,340	76	4,679	5,406	13,044
Truck and Bus	357	563	67	988	1,075	2,676
1954:						
Jan. (total)	2,891	3,993	118	7,002	6,299	14,977
Passenger Car.	2,549	3,378	59	5,986	5,251	12,279
Truck and Bus	342	615	59	1,016	1,048	2,698
Feb. (total)	2,634	3,557	117	6,308	7,042	15,709
Passenger Car.	2,323	3,001	60	5,384	5,952	12,832
Truck and Bus	311	556	57	924	1,089	2,877
Mar. (total)	3,163	4,350	116	7,629	7,981	16,077
Passenger Car	2,809	3,753	45	6,607	6,878	13,112
Truck and Bus	354	597	71	1,022	1,103	2,966
Apr. (total)	3,131	4,935	176	8,243	8,065	15,906
Passenger Car	2,785	4,328	95	7,208	7,031	12,955
Truck and Bus	346	607	81	1,035	1,034	2,951

Source: The Rubber Manufacturers Association, Inc.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1934	2,177,919	575,192	2,753,111	1944	0	124,819	124,819
1935	3,252,244	694,690	3,946,934	1945	83,792	313,643	397,435
1936	3,669,528	781,862	4,451,390	1946	2,148,699	930,760	3,079,459
1937	3,915,889	892,382	4,808,271	1947	3,558,178	1,220,634	4,778,812
1938	2,000,985	485,852	2,486,837	1948	3,909,270	1,363,856	5,273,126
1939	2,866,796	704,308	3,571,104	1949	5,108,841	1,123,736	6,232,577
1940	3,692,328	721,637	4,413,965	1950	6,665,836	1,332,263	7,998,099
1941	3,744,500	875,381	4,619,681	1951	5,337,729	1,420,432	6,758,161
1942	220,814	133,083	353,897	1952	4,320,794	1,212,790	5,533,584
1943	0	4,501	4,501	1953	6,121,787	1,202,196	7,323,983
1953:							
Jan.	453,319	111,599	564,918	July	599,134	105,622	704,756
Feb.	486,071	96,740	582,811	Aug.	513,457	101,478	614,935
Mar.	566,320	134,129	700,449	Sept.	475,289	98,051	573,340
Apr.	596,633	126,754	723,387	Oct.	528,088	91,955	620,043
May	549,677	93,443	643,120	Nov.	378,406	73,710	452,116
June	587,549	74,063	661,612	Dec.	387,844	94,652	482,496
1954:							
Jan.	454,562	96,167	550,729	July	.....	.....	.....
Feb.	446,676	87,141	533,817	Aug.	.....	.....	.....
Mar.	531,529	101,177	632,706	Sept.	.....	.....	.....
Apr.	534,667	96,723	631,390	Oct.	.....	.....	.....
May	549,677	93,443	643,120	Nov.	.....	.....	.....
June	.....	.....	.....	Dec.	.....	.....	.....

Source: Automobile Manufacturers Association.
Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Automotive Inner Tubes

(Thousand Units)

Year	Shipments: Original Equipment	Shipments: Replacement	Shipments: Export	Shipments: Total	Production	Inventory End of Period
1942	6,895	7,213	159	14,267	12,685	6,206
1943	6,350	12,474	189	19,014	15,014	2,626
1944	6,460	20,569	196	27,224	27,488	2,813
1945	5,988	33,906	411	40,304	41,742	3,627
1946	15,327	59,357	1,424	76,108	77,251	3,820
1947	25,046	46,560	2,483	74,088	79,181	3,059
1948	26,833	40,548	1,119	68,499	70,033	3,641
1949	31,521	31,450	887	63,858	65,114	10,657
1950	41,240	42,671	811	84,723	80,179	..
1951	32,151	32,284	1,071	65,507	67,249	10,094
1952	29,451	32,985	1,014	63,449	65,073	12,036
1953	37,972	36,110	882	74,965	74,514	11,564
1953:						
June	3,539	3,298	71	6,907	7,035	12,811
July	3,614	3,600	73	7,288	6,395	12,097
Aug.	3,139	3,315	75	6,529	5,679	10,226
Sept.	2,841	2,768	111	5,720	5,656	11,288
Oct.	3,156	2,696	107	5,960	5,752	10,904
Nov.	2,222	1,708	76	4,006	4,738	11,611
Dec.	2,620	1,917	87	4,625	4,535	11,564
1954:						
Jan.	2,884	3,892	58	6,834	5,395	10,107
Feb.	2,636	2,908	74	5,617	5,896	10,448
Mar.	3,165	2,774	74	6,013	6,399	10,869

Source: The Rubber Manufacturers Association, Inc.

Rim Production

	1949	1950	1951	1952	1953
Passenger Car	27,715,344	35,096,404	29,145,367	24,936,844	31,318,461
Truck & Bus	4,238,174	6,625,129	6,877,419	5,752,674	5,228,321
Agricultural	2,695,430	2,853,483	3,019,581	2,073,116	1,943,487
Earth Mover	9,895	15,602	28,026	31,791	24,685
Total	34,658,843	44,590,618	39,070,393	32,794,425	38,514,954

	1953 Dec.	1954 Jan.	Feb.	Mar.	Apr.	May
Passenger Car	2,154,376	2,156,823	1,968,868	2,601,710	2,336,375	2,297,021
Truck & Bus	445,950	447,581	338,416	416,802	412,640	420,449
Agricultural	109,852	89,324	152,293	153,938	141,358	104,504
Earth Mover	1,253	1,670	1,472	1,819	2,498	2,890
Total	2,711,431	2,695,398	2,461,049	3,174,269	2,892,871	2,824,864

Source: The Tire & Rim Association, Inc.

Gasoline Consumption

(In Thousands of Barrels of 42 Gallons)

	1947	1948	1949	1950	1951	1952	1953	1954
Jan.	57,057	61,308	63,125	66,981	80,670	86,863	89,634	89,852
Feb.	50,551	56,487	57,980	53,274	72,864	82,043	86,458	86,206
Mar.	59,947	68,171	73,282	78,780	86,962	87,065	98,158	101,549
Apr.	64,140	72,183	75,318	80,350	87,573	98,653	102,044	.....
May	70,865	77,186	81,665	89,035	100,266	101,137	105,918	.....
June	71,329	78,044	83,374	90,174	96,364	99,305	114,703	.....
July	73,441	81,428	83,129	91,677	100,567	105,307	112,960	.....
Aug.	72,089	80,351	84,707	94,507	101,433	102,954	109,124	.....
Sept.	71,384	76,159	80,832	86,723	91,891	100,095	106,158	.....
Oct.	73,277	75,164	79,327	89,067	100,209	103,689	106,037	.....
Nov.	64,158	72,560	76,346	82,688	88,581	91,326	99,210	.....
Dec.	67,506	72,162	75,628	81,032	84,551	95,817	100,225	.....
Total	795,015	871,270	913,713	994,290	1,091,951	1,154,254	1,230,629	.....

Source: U. S. Bureau of Mines.

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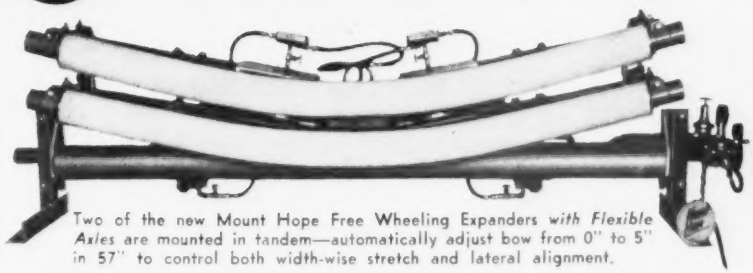

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Powdered Rubber

Various Compounding Materials Consumed by the Rubber Industry

Material	1947	1948	1949	1950	1951	1952	1953
Antimony, Primary:							
Short tons	39	41	55	103[c]	19[c]	66	.....
% of total	.002	.003	.005	.007	.001	.005	.....
Asphalt: [a]							
Short tons	32,113	19,967	18,050	26,819	21,414	33,288	.....
% of total	0.7	0.4	0.3	0.3	0.3	0.4	.....
Barite (Barytes):							
Short tons	17,000	18,000	14,000	19,000	15,000	14,000	.....
% of total	3.1	2.85	2.53	3.31	2.13	2.0	.....
Carbon Black:							
Short tons	471,790	435,282	383,565	515,184	530,614	537,273	.....
% of total	94.3	95.5	93.3	92.9	93.9	93.1	.....
Clay, Kaolin:							
Short tons	166,201	176,965	197,341	263,306	231,331	240,982	.....
% of total	11.5	11.3	13.1	15.0	12.7	13.2	.....
Clay, Fire & Stoneware:							
Short tons	17,970	15,480	27,148	9,500	.....	9,322	.....
% of total	0.2	0.2	0.3	0.1	.....	0.1	.....
Lime:							
Short tons	589	1,154	715	908	1,126	2,000	.....
% of total	0.01	0.02	.0002	.0002	[d]	[d]	.....
Litharge:							
Short tons	2,205	2,835	1,398	3,047	2,641	2,109	.....
% of total	1.3	1.8	1.2	1.7	1.7	1.5	.....
Lithopone:							
Short tons	3,085	4,192	3,245	4,092	3,295	1,523	.....
% of total	1.9	3.0	4.1	3.9	3.2	2.5	.....
Mica, Ground:							
Short tons	3,900	4,372	3,856	5,776	6,551	5,126	.....
% of total	6.0	7.0	7.0	8.0	9.0	7.0	.....
Sulfur:							
Short tons	72,800	70,560	59,360	75,000	75,000	75,000	.....
% of total	1.8	1.7	1.5	1.3	1.6	1.6	.....
Talc: [b]							
Short tons	71,840	66,226	53,400	75,900	70,970	64,476	.....
% of total	13.9	13.0	12.0	12.0	11.2	10.9	.....
Zinc Oxide:							
Short tons	82,248	82,895	58,496	82,944	71,507	72,774	.....
% of total	51.2	54.9	52.5	51.6	48.4	51.2	.....

Source: U. S. Bureau of Mines.
Notes: (a) Solid and semi-solid products of less than 200 penetration. (b) Includes prophyllite and ground soapstone. (c) Does not include precipitated antimony sulfide as in previous years. (d) Negligible.

Reclaimed Rubber

(Including Natural and Synthetic)

(All Quantities in Long Tons)

Year	Production	Consumption		Exports	Stocks On Hand at End of Period
		Tons	% to Crude [a]		
1937	185,033	162,000	29.8	13,233	28,800
1938	122,400	120,800	27.6	7,403	23,000
1939	186,000	170,000	28.7	12,611	25,250
1940	208,971	190,244	29.3	11,347	32,636
1941	274,202	251,231	32.2	13,851	41,750
1942	286,007 [b]	254,820	64.6	30,405	42,532
1943	304,058 [c]	291,082	59.6	15,678	46,201
1944	260,631 [d]	251,083	35.3	11,800	43,832
1945	243,309	241,036	30.2	13,413	28,155
1946	295,612	275,410	26.5	14,461	33,666
1947	291,395	288,395	24.8	14,556	35,943
1948	266,861	261,113	24.4	11,428	32,630
1949	224,029	226,679	22.5	10,637	28,263
1950	314,008	303,733	24.1	11,740	35,708
1951	366,700	346,121	28.6	14,722	45,082
1952	274,981	280,002	22.2	11,180	30,664
1953	298,336	285,050	21.3	11,597	32,319
1953:					
June	26,554	24,637	20.5	962	32,791
July	23,292	23,414	22.3	807	31,506
Aug.	22,607	22,666	22.0	638	30,318
Sept.	23,469	22,409	21.6	894	30,147
Oct.	23,649	21,944	20.8	823	30,692
Nov.	21,323	19,638	20.5	1,086	31,226
Dec.	21,463	18,858	20.2	1,031	32,319
1954:					
Jan.	20,026	19,114	19.7	912	31,865
Feb.	21,122	19,461	20.3	941	32,393
Mar.	23,383	22,882	20.8	830	32,148
Apr.	21,712	21,762	20.8	886	31,796

Source: U. S. Department of Commerce.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (a) Includes natural and synthetic rubber. (b) Includes 893 tons of imports. (c) Includes 67 tons of imports. (d) Includes 21 tons of imports.

Cotton, Rayon and Nylon Tire Fabrics

(Production in Thousands of Pounds)

	Cotton				Rayon and Nylon [b]		
	Tire Cord Not Woven	Cord Fabric Woven	Chafer and All Other Tire Fabrics	Total	Tire Cord not Woven	Tire Cord and Other Tire Fabrics	Total
1950:							
Jan.-Mar.	3,939	19,210	12,948	36,097	12,469	60,981	73,450
Apr.-June	11,077	29,498	14,071	54,646	11,510	59,966	71,476
July-Sept.	10,529	39,792	15,101	65,152	13,161	61,614	74,775
Oct.-Dec.	13,314	37,759	14,405	65,578	12,942	63,399	76,341
Total	38,859	126,259	56,525	221,473	50,082	245,960	296,476
1951:							
Jan.-Mar.	11,497	38,269	16,737	66,503	11,878	65,512	77,390
Apr.-June	12,608	42,491	17,055	72,154	11,979	61,957	73,936
July-Sept.	16,744	44,340	17,433	78,517	12,091	67,982	80,073
Oct.-Dec.	14,237	43,820	13,899	71,956	*a*	83,354	83,354
Total	55,116	168,920	65,124	289,160	35,948	278,805	314,753
1952:							
Jan.-Mar.	11,226	36,378	12,971	60,575	14,434	72,249	86,683
Apr.-June	4,661	24,612	10,742	40,015	16,874	81,249	98,123
July-Sept.	335	9,257	9,460	19,052	18,128	80,355	98,483
Oct.-Dec.	*c*	4,728*a*	11,580	16,308	19,436	81,171	100,607
Total	16,222	74,975	44,753	135,950	68,872	315,024	383,896
1953:							
Jan.-Mar.	*c*	4,378*a*	15,477	19,855	20,487	91,742	112,229
Apr.-June	*c*	5,713*a*	15,880	21,593	18,906	95,711	114,617
July-Sept.	*c*	3,562*a*	13,193	16,755	18,597	89,821	108,418
Oct.-Dec.	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

Source: Bureau of the Census, U. S. Department of Commerce.
Notes: (a) Included with tire cord and fabrics to avoid disclosures of operations of individual mills. (b) Fuel cell fabrics are not included with rayon and nylon tire cord and fabrics. (c) Included with tire cord not woven. (d) Included with chafer and all other tire fabrics.

Consumption of Vinyl Resins

(In Thousands of Pounds)

Year	Sheeting and Film [a]	Textile and Paper Coating Resins	Molding and Extrusion Materials	All Other
1950	227,149	46,044	113,889	21,868
1951	161,547	43,688	134,890	23,934
1952	154,902	42,298	140,872	31,793
1953:				
Jan.	14,830	4,284	15,424	3,076
Feb.	16,516	4,145	13,847	2,919
Mar.	17,575	4,950	14,906	3,683
Apr.	16,574	4,934	15,332	2,800
May	14,766	4,126	13,509	3,084
June	.....	.....	.....	.....
July	.....	.....	.....	.....
Aug.	.....	.....	.....	.....
Sept.	.....	.....	.....	.....
Oct.	.....	.....	.....	.....
Nov.	.....	.....	.....	.....
Dec.	.....	.....	.....	.....

Source: U. S. Tariff Commission.
Note: (a) Includes weight of fillers, plasticizers, extenders and safety-glass sheeting. Beginning January, 1951, statistics are listed on a resin content basis.

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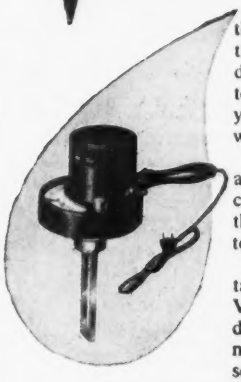

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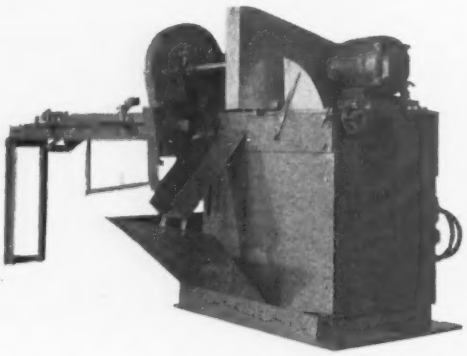

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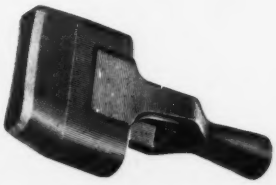

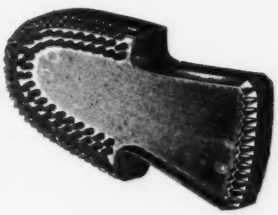

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POSITIONS WANTED

PLANT MANAGER and ENGINEERING TECHNICAL DIRECTOR, wishes to locate with small rubber company manufacturing foam rubber, latex dip goods, and mechanical rubber items. 25 years in the rubber industry. Address Box 124-P, RUBBER AGE.

DEVELOPMENT WORK, sales service or direct sales. Twenty-five years experience latex compounding. Boston area. Address Box 128-P, RUBBER AGE.

CHEMICAL ENGINEER with 8 years experience in compounding, production of mechanical rubber goods, and process and design engineering. At present, head of rubber and plastic department of valve manufacturer, but seeks a more challenging job with opportunities to advance in management. Address Box 130-P, RUBBER AGE.

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CHEMIST, Ph.D., 12 years experience in molded and lathe-cut goods. At present employed. Wants responsible position with progressive concern. Highest references. Address Box 137-P, RUBBER AGE.

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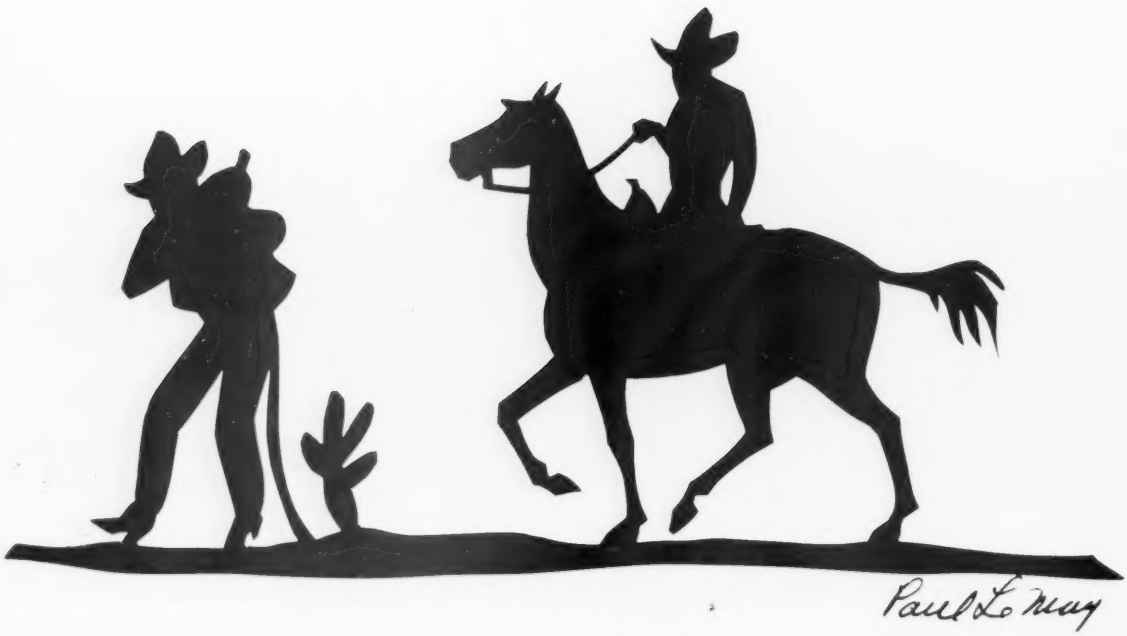

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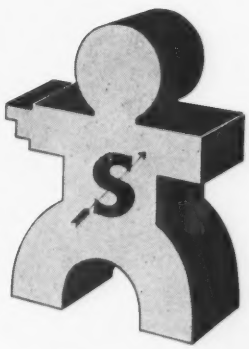

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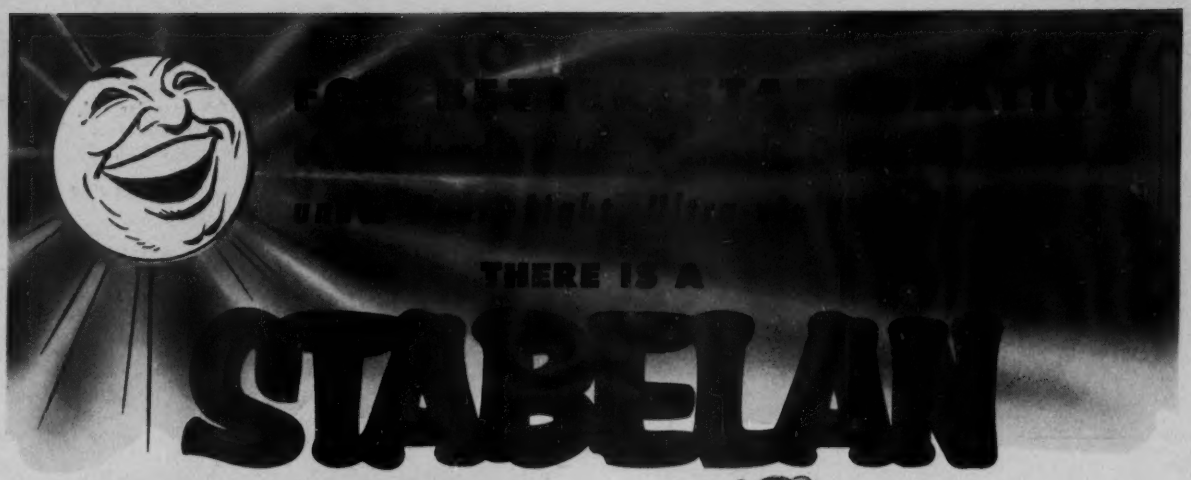

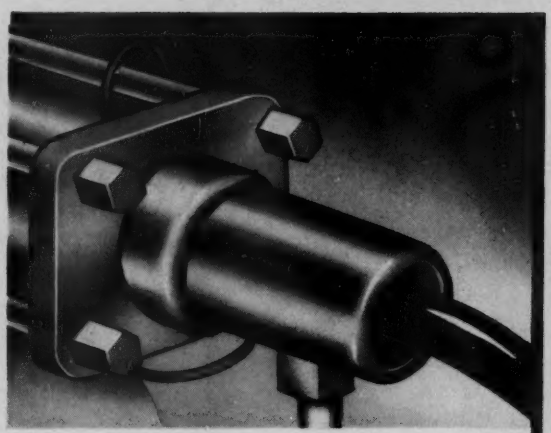

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